The FOUNDRY

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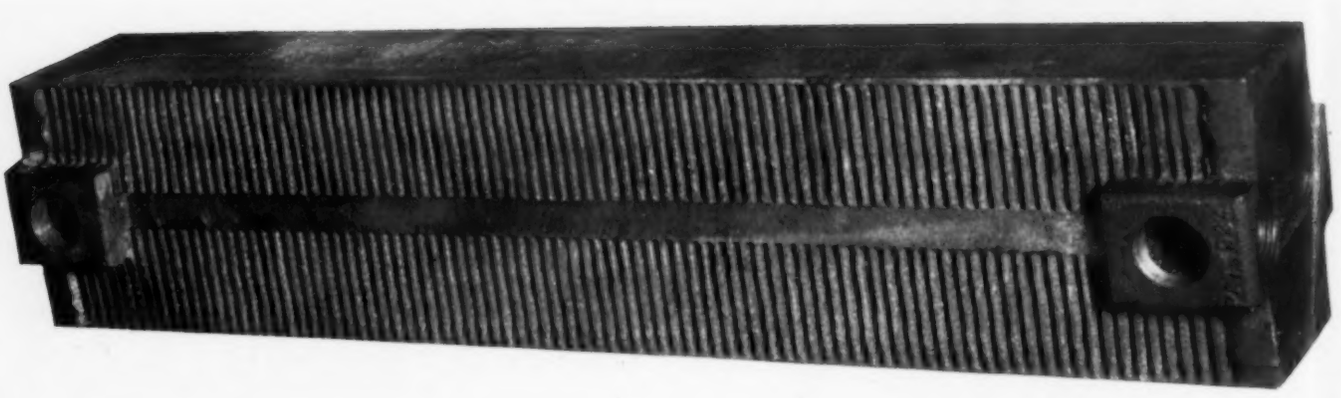

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THE FOUNDRY

Rise in Operations Should Continue, Survey Shows

IMPROVEMENT in foundry operations throughout the country should continue during the next few months, according to a survey recently conducted by THE FOUNDRY and reported on page 25 of this issue. Twenty-five per cent of foundrymen participating in the study believe immediate prospects for an increase in business are good, while 50 per cent described the outlook as fair. Looking further ahead, 22 per cent consider prospects good for the remainder of the second quarter and 50 per cent see a fair chance for improvement.

Since the previous survey in July, 1938, average foundry activity has increased from 46 to 55 per cent of capacity. The study also indicates foundries are averaging 4¼ working days a week. During the past nine months the Eastern states have experienced greatest improvement in foundry operations, followed in turn by the Middle West, the Far West and the South. Statistics provided by the survey show very little variation in average operations of the various sections.

Reports from equipment and supply manufacturers reveal considerable foundry interest regarding improvements to plant and equipment. Many foundries are buying equipment, as witnessed by the continued improvement in sales, reported by the Foundry Equipment Manufacturers association. On the other hand, plans are being held in abeyance in numerous instances pending further improvement in the demand for castings. The point at which the dam of orders will be released is problematical, but in all probability, those who wait too long may find it impossible to secure deliveries on equipment at a time when new equipment will be needed most.

Selling Is the Big Job

FREQUENTLY W. J. Cameron of the Ford Motor Co., makes a remark on his Sunday evening broadcast which seems to apply particularly to the foundry industry. The following from a recent radio talk on "Shovel Leaners" describes the state of mind into which numerous foundrymen have fallen:

Depending on some sort of outside help has become so general a habit that it has got every part of society somewhat down. Most of us, in some manner, are leaning on shovels—leaning on economic excuses or economic hopes, leaning on future outlooks, leaning on some form of public policy. It is more or less epidemic in all classes of people. And it has but one source—the fond expectation that somebody or something is going to do for us what we finally shall have to do for ourselves.

For a long time we have been watching the big parade, the big show, something that has insistently drawn our eyes away from our job. But now the job has become the real show. Many saw this point long ago. Some were slower. Those who see it actually are moving ahead. They are using their shovels.

The foundry industry has made wonderful strides in its manufacturing processes. The big job now is to sell castings intelligently in the face of competition which is bitter and often unfair.

Cincinnati Offers Values

PROGRAM for the annual convention of the American Foundrymen's association, to be held in Cincinnati, May 14 to 18, includes papers on a wide variety of subjects. Evening meetings and as high as four simultaneous sessions during the day are required to include all the papers and reports available for discussion. The convention program cuts completely across the technical and practical phases of foundry practice, and at the same time offers a forum for several problems of management, including safety and hygiene, apprentice training, and costs.

Structure of the program is provided by sessions devoted to papers and informal discussions dealing with gray iron, malleable iron, steel and nonferrous foundry problems. Practical information of interest to the operating foundryman will be developed in four gray iron shop course sessions and the vast majority of convention visitors should find much of extreme value in the four course lecture on "Elementary Metallurgy and the Use of the Microscope." The plant visitation program at Cincinnati should be particularly valuable, due to the wide diversity of foundries operated in the Queen City and the surrounding district. The organized works visit on Monday afternoon is especially attractive.

While it is true that an exhibit, one of the feature attractions of the past three annual meetings, will be missed, the exceptional quality of the program arranged by the association officers, and the unusual opportunities for works visits arranged by the local committee, more than justify attendance at Cincinnati of every association member.

Frank G. Steinebach
Editor

Charging the

By A. W. GREGG
Foundry Engineer
Whiting Corp., Harvey, Ill.

NEED for further mechanization in the foundry industry is pressing. Rising costs of both materials and labor, fixed hours of work, heavier taxes and keen competition, make the foundryman's task of producing good castings at a profit increasingly difficult. Need for mechanization particularly is apparent in the charging and melting department which too frequently is out of step with other phases of foundry operation, such as molding, cleaning and sand preparation. Because the job of making a profit is becoming more and more difficult, foundrymen will have to give that phase of the work greater consideration. A noticeable improvement in that direction, already has appeared, due in part to greater interest in mechanization and also to improved methods and equipment provided by the suppliers.

Many Factors To Be Considered

Every problem of mechanical charging involves fundamental principles which must be analyzed intelligently if maximum benefit is derived from the equipment. Failure to make a complete analysis accounts for some installations doing only a halfway job. Principal factors for such a study are as follows:

Analysis of present melting practice. Every step should be studied with special regard to its relation to every other part of the process. Only a true picture of present practice and conditions will permit the designer of charging equipment to interpret correctly the needs and possibilities of any given problem. This in part includes: Length of heat in hours; total iron melted in tons; shutdown periods, when and how long; size of charges in pounds, both coke and iron; density of iron charges in pounds per cubic foot; largest pieces and kind of scrap materials used; number of men on the charging floor. The following details of cupola must be known: If hot blast is used, what kind; inside diameter at melting zone in inches;

Fig. 1 (Left)—Electric scale car with cone bottom charging bucket in place to receive coke. Fig. 2 (Right)—Bucket loading station is located under material bins and permits rapid make-up of iron charges. Fig. 3 (Right above)—Skip hoist charger is adapted particularly for small and medium size cupolas where raw materials are near the cupola. Hoisting mechanism is enclosed completely and mounted above floor level, out of the way

Cupola Mechanically

inside diameter at charging zone in inches; shell diameter; distance from bottom plate to cupola foundation; distance from bottom plate to lower sill of charging door; overall height of cupola, from foundation to top of stack.

Analysis of material-handling practice. This phase of operation, particularly in large plants with heavy tonnage, holds tremendous possibilities for cost reduction. Too frequently it receives little or no consideration. The following factors are important. How is incoming material unloaded; if storage bins are used, how many and what size for coke, pig iron, scrap and limestone; are charges delivered to cupola house by hand, crane, electric car or other means; are charges elevated to charging floor by elevator, crane monorail or other means; if yard crane is used, what is capacity and speeds; can existing tracks be moved if desired;

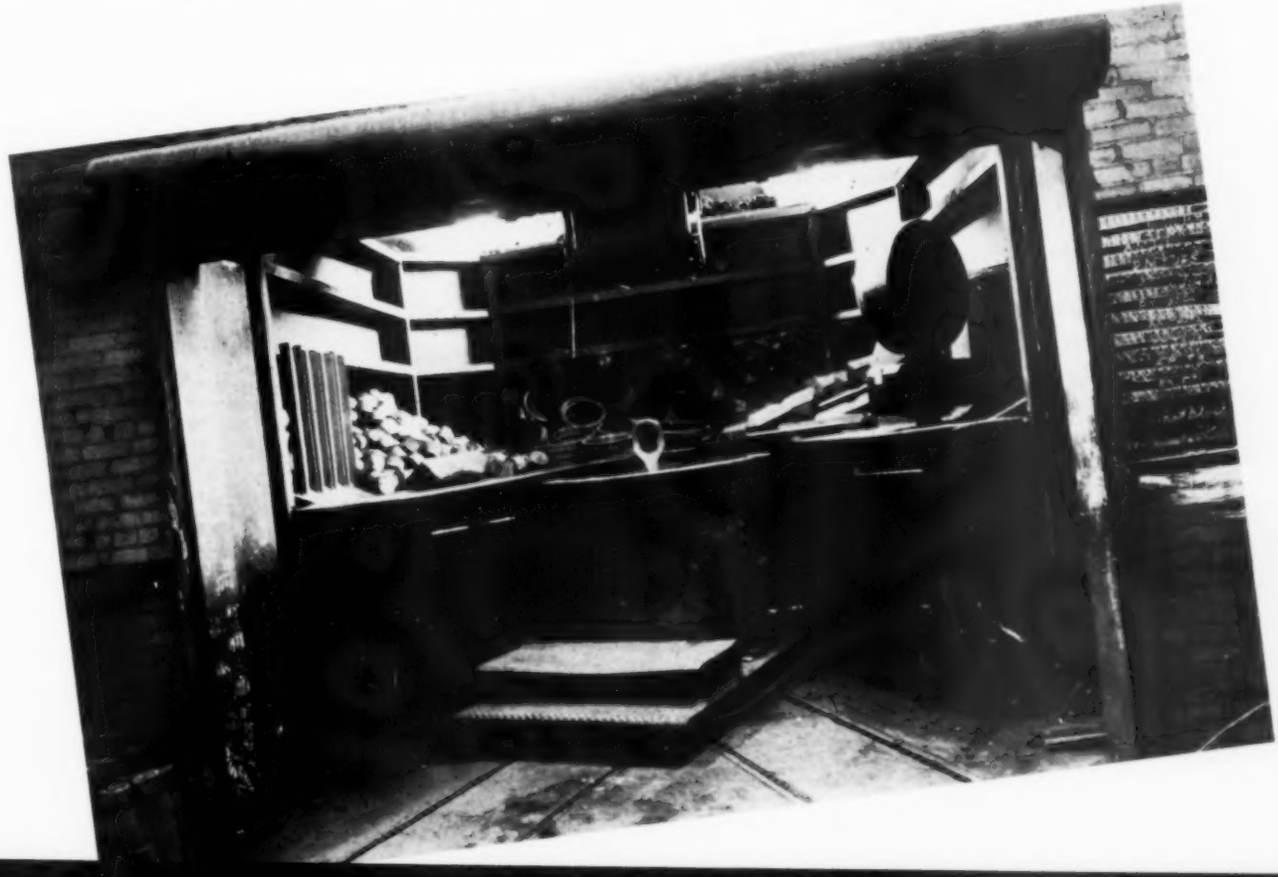


Fig. 4 (Above)—Another form of wishbone charger. Foundry roof was low and new opening was made to get proper distance for efficient operation. Fig. 5 (Right)—Plane and elevation of crane type system serving 4 cupolas. Capable of charging 30 tons of iron per hour

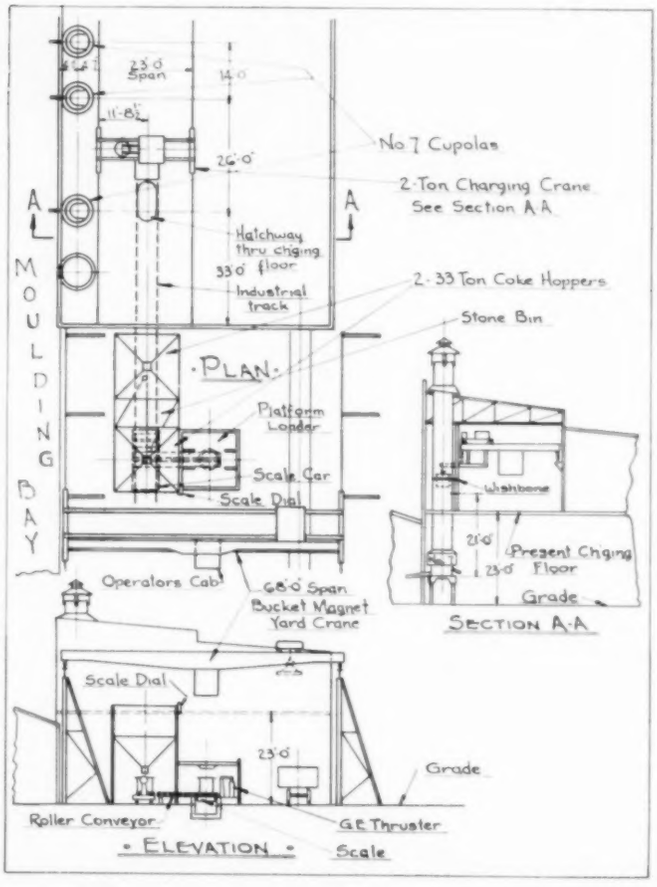
how many men are employed in making up charges, not including those on the charging floor; electric current available for crane and charging equipment.

Layout of present buildings and facilities. If not already available, drawings should be made of building and yard space, showing location of cupolas, adjacent buildings, tracks, material bins or piles, cranes, charging floor, elevator, scale cars and all other items at present in use, with correct measurements for use of the designing engineer in making up proposed changes.

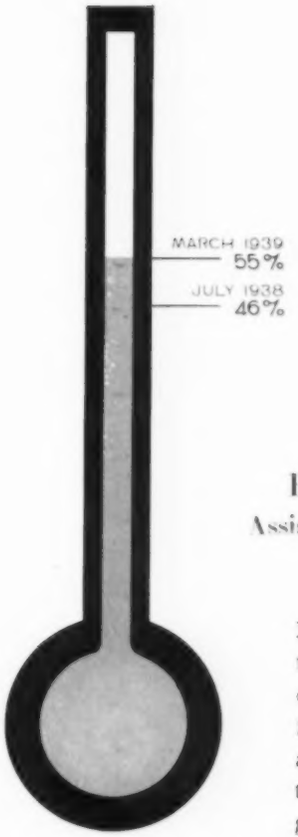
Given the principal data previously outlined, the competent designer of mechanical charging apparatus is prepared to proceed with the actual working out of the problem. First of all, he will establish a cycle of operation to fit local requirements: For example, a given foundry requires hot metal at the rate of 20 tons per hour. (These calculations are based on the rate per hour). With iron charges of 2000 pounds each and coke and iron put in together, it is necessary to make 20 charges per hour, or one every 3 minutes. Three minutes therefore is allowed for one complete cycle. With only 3 minutes per cycle, it is necessary to have the greatest possible degree of mechanization. A magnet crane for unloading materials and making up charges would be well justified; also overhead coke and stone bins, together with a towing device to move charging buckets from loading points to scale and from scale to pickup point. For the amount of tonnage involved, a crane type mechanical charger would be the logical choice. Every movement of material must be calculated carefully and all operations synchronized. Speeds of all handling equipment must be determined so as to meet the requirements for a complete cycle every 3 minutes.

Assuming the adoption of equipment just mentioned, the labor requirements would be three men distributed as follows: One on the yard crane, one on the ground to weigh coke and stone and operate the towing device, and one on the charging crane. No one would be required on the charging platform. In fact, no charging platform would be necessary other than a small service platform for the convenience of the cupola tender.

Similar calculations should be made for any size foundry, although on the smaller tonnages the problem would be more simple. For example in an average foundry melting only 5 tons per hour there would be no justification for elec- (*Please turn to page* 73)



How Is Business?



By GEORGE POPE
Assistant Advertising Manager
The Foundry

IF YOU had posed the question, "How Is Business?", to several hundred foundrymen, as THE FOUNDRY did recently, you would have received answers something like this: Two out of ten would have said, *Good*, 5 would have stated, *Fair*, and 3 would have replied, *Poor*, or words to that effect.

Such, at least, are the conclusions drawn from a second survey of foundry opinion on this interesting question just completed, and covering a cross-section of the foundry industry in nineteen states. In substance, the present and future prospects for foundry business may be summed up briefly as follows:

55 per cent is the rate of operation of the foundry industry.

4¼ working days a week prevail on an average.

20 per cent improvement in business since last July is the foundry industry's share of recovery.

25 per cent say immediate prospects for business are good while 50 per cent describe theirs as fair.

22 per cent say May and June prospects are good, 40 per cent say fair, but 27 per cent "don't know."

It will be noted in referring to Table I that the East has led in the business upturn, Connecticut and New Jersey being substantial contributors to the increase in foundry activity in that section. Wisconsin and Michigan were important factors in the ten point gain reported from the Middle West. Incidentally both the East and the Middle West, were somewhat behind the South and Far West in foundry activity last July, whereas the situation now is reversed, the latter two sections showing only moderate increases, as a whole, in the past 9 months.

As a matter of record, it may be interesting to note that the July survey showed a national average capacity of operation of 46 per cent. The rate for the East was 44 per cent, Middle West 44 per cent, South 53 per cent, and Far West 42 per cent. The composite number of working days weekly for all sections was then slightly *under* 4 days, is now somewhat *over* 4 days.

Recalling the comment of one foundry executive who said during the July sampling, "We are operating at zero capacity, believe August will be worse, and September uncertain," it seemed worthwhile to ascertain, if possible, (*Please turn to page* 96)

Table I

Foundry Operations by Districts

State	Number Days Working Week	Per cent Capacity Operation	Compared with July 1938	State	Number Days Working Week	Per cent Capacity Operation	Compared with July 1938
Michigan	4.18	56.9	+14.8	Alabama	3.93	55.9	— 4.9
Ohio	4.26	50.0	+ 5.0	Virginia	4.38	56.3	+ 2.8
Illinois	4.29	54.2	+11.5	Texas	4.31	52.1	+18.1
Indiana	3.80	50.3	+ 7.3	Tennessee	4.43	57.9	+ 1.9
Missouri	4.00	53.1	+ 3.8	Georgia	4.17	60.0	Same
Wisconsin	4.38	58.9	+18.4	**South**	**4.24**	**56.42**	**+ 3.56**
Middle West	**4.15**	**53.90**	**+10.13**	California	4.55	54.2	+ 7.4
Pennsylvania	4.36	57.8	+ 8.5	Oregon	3.90	36.0	— 1.5
New York	4.07	49.7	+13.2	Washington	4.62	54.0	+13.4
New Jersey	4.10	68.4	+16.4	**Far West**	**4.36**	**48.07**	**+ 6.44**
Massachusetts	4.21	49.3	+ 7.3				
Connecticut	4.73	63.3	+24.9	**Composite**			
East	**4.29**	**57.68**	**+14.04**	**All Sections**	**4.25**	**54.64**	**+ 8.88**

Table II

Operations by Product

Type	Per cent Capacity
Automotive	69
Municipal	69
Farm Implement	68
Plumbing, Building	61
Jobbing (highly diversified)	58
National Average	**55**
Jobbing (moderately diversified)	53
Railroad	51
Machinery	51
Stove, Hardware	40
Oil field	39

This table based on information provided by foundries whose *principal* line is that indicated.

Gray

By C. H. LORIG
Supervising Metallurgist
Battelle Memorial Institute, Columbus, O.

This is the second and concluding article from a paper by the author presented at a meeting of the Chicago Chapter of the American Foundrymen's association. The first article appeared in the February issue.
—The Editors

GRAY cast iron also has wearing qualities under most conditions very much superior to other materials of construction. This characteristic of cast iron perhaps is unusual and often too little appreciated. Success of cast iron in reresisting wear depends largely on its microstructure. Its resistance to wear has been ascribed to the lubricating power of the graphite, to the heterogeneous nature of the matrix, and to the hard carbides and phosphides that may be present.

Lubricating power of graphite is problematical. For the ordinary grades, best wear is obtained in low-carbon, low-silicon irons with a pearlitic matrix and with graphite in coarse, flake form. Further improvements may be realized sometimes by heat-treating to higher hardness values. Under some conditions phosphorus seems to decrease wear decidedly, but in others its value is doubtful and sometimes it is detrimental.

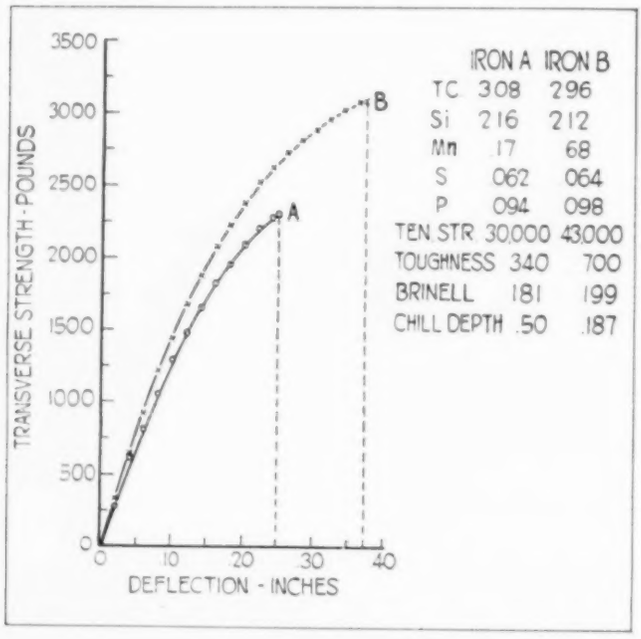


Fig. 5—Transverse-deflection curves for low carbon cast irons shown in Figs. 3 and 4, heated to 2750 degrees Fahr. and poured at 2550 degrees Fahr. Iron A was given no ladle treatment. Iron B was treated in ladle with 0.50 per cent silicon as 75 per cent grade ferrosilicon. Note properties, particularly values and depth of chill

Carbide and carbide-forming elements generally decrease wear of iron, as could be expected. Fine dendritic graphite is detrimental to wear qualities, and the presence of ferrite increases wear to a marked degree. Combination of fine graphite and ferrite makes for poor wear resistance. Neither hardness nor tensile strength permits any conclusion on wear resistance, since wear depends primarily on the nature of the microstructure.

Wear Resistance Not Based on Hardness

Where the irons are made in a foundry under standardized melting and casting conditions, then it is quite possible to use hardness values as an indicator of relative wear values, the wear resistance increasing with increased hardness. However, as a rule, irons from different sources cannot be compared in wear resistance on the basis of hardness values alone.

Many contradictory data on wear testing have been obtained, showing that the problem of wear not only is complicated but is difficult to standardize. This is probably because wear is not confined to properties of one material only but is a study of the rubbing of two surfaces in contact, and the characteristics of each influence the rate of wear on each other.

Gray iron, as a whole, resists wear very well in-

Iron.....

Metallurgical Practice

deed; yet relative wear between irons may differ as much as several times. Since wear resistance is not an inherent property of material but depends on the nature of the two surfaces rubbing together, it has proved unsatisfactory, unless the test method closely simulates service conditions, to determine by accelerated tests the probable resistance of a given iron to wear in service.

What has been said about damping, notch-bar sensitivity, and wear resistance illustrates that strong irons are neither necessary nor desirable in all applications, and that the structure, wholly apart from physical properties, is much more critical as regards the value of an iron in some applications.

All methods used to improve the structure and properties of cast iron have, consciously or not, been attempts to control graphitization, whether steel mixtures were used, silicon and carbon reduced, superheating applied, or ladle additions and alloys employed. Different processes have been employed in different foundries, and irons of practically the same engineering properties have been produced from different compositions.

In the matter of structural control, carbon and its distribution are most important. Most of the other elements affect the occurrence of carbon in iron, and

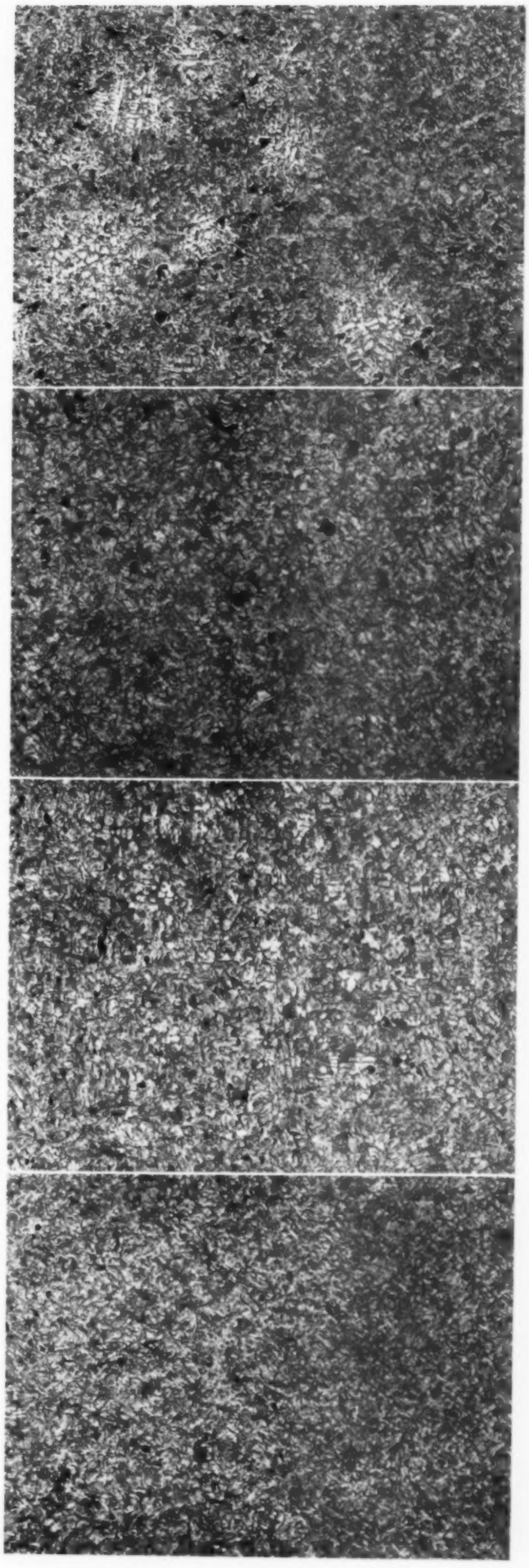


Fig. 6 (Top)—Marked dendritic arrangement of graphite and some ferritic patches shown in iron from series in Fig. 1. Untreated iron, heated to 2750 degrees and poured at 2550 degrees Fahr., 20 diameters, tensile strength 30,000 pounds per square inch. Fig. 7 (Upper center)—Absence of dendritic graphite and ferrite shown in series from Fig. 3. Treated with ferrosilicon, heated to 2750 degrees and poured at 2550 degrees, 20 diameters, tensile strength 43,000 pounds per square inch. Fig. 8 (Lower center)—Untreated iron from series in Fig. 1 showing marked dendritic arrangement of graphite and fully pearlitic matrix. Heated to 3150 degrees and poured at 2550 degrees, 20 diameters, tensile strength 34,500 pounds per square inch. Fig. 9 (Bottom)—Ferrosilicon treated iron from series in Fig. 3 showing absence of dendritic graphite and ferrite. Heated to 3150 degrees and poured at 2550 degrees, 20 diameters, tensile strength 51,000 pounds per square inch

the carbon through its size, shape, distribution, and amount affects the strength and other qualities, like wear, of the iron. Size of graphite, everything else being the same, is influenced by amount of carbon in the iron, melting conditions, and rate of cooling.

Influence of the latter two factors is well illustrated in welded cast iron structures in which deposited metal, while having perhaps the same composition as the parent metal, has a structure which never is similar to that of the parent metal. Graphite may vary in shape from long, coarse, graphite flakes to finely dispersed graphite in dendritic structures. This dendritic structure type of graphite is more common when the total carbon content is low. Its formation is favored by certain furnace practices and by rapid cooling, particularly in thin sections.

Combination May Be Deleterious

A ferritic matrix in low-carbon irons often is associated with the finely divided graphite, and the two combined make for a poor quality iron. This is especially true with regard to tensile and transverse strengths, to deflection, to toughness, and to wear resistance. Wear on such irons is very rapid and is known to cause much trouble in the performance of certain parts that must resist wear.

Silicon softens iron through its graphitizing effect. However, it also strengthens the ferrite, and in pearlitic irons it sometimes is used in quantities above normal to increase strength. High silicon irons, with more than 4 per cent silicon, are brittle but are beginning to find use for resisting growth and high temperature scaling. Some special compositions are being employed for corrosion resistance. However, for irons in the normal range of composition, it is fundamentally important to adjust carbon and silicon contents carefully to the size of casting poured in order to develop high strength.

Manganese in normal amounts usually is considered as having no marked effect on properties of iron. It has two major influences. Chill in iron can be controlled through the manganese-sulphur ratio. Manganese in manganese sulphide is in the ratio of 1.7 times the sulphur content. About 0.3 per cent of manganese in excess of that required to form manganese sulphide normally is required to minimize the chilling effect of sulphur and to produce a chill that grades slowly into the gray structure beneath.

When the sulphur content is high in relation to manganese content, a distinct line of demarcation exists between chill and gray iron, as shown by work of Spencer *Transactions* A. F. A., 1935. Such chill surfaces are distinctly of inferior quality. An interesting point in regard to low manganese in lower carbon, superheated iron is that the iron usually has inverse chilling tendencies.

Manganese Stabilizes the Pearlite

Second and equally as important influence is that manganese tends to stabilize pearlite and, therefore, in sufficient quantities makes it more difficult for ferrite to form. This effect of manganese very easily could be utilized to help overcome formation of primary ferrite in thin sections or in sections that are cooled more rapidly by chilling. Primary ferrite in such sections often occurs for a short distance beneath the surface and very greatly diminishes wear and abrasion resistance. All foundries making machine tool castings seemed to be plagued by the occurrence of such ferrite in (*Please turn to page* 74)

Charge Mixtures and Chemical Compositions

First Irons Taken from Each Heat of Untreated and Silicon-Treated High-Frequency Furnace Cast Irons

Type of Cast Iron	Charge Mixtures	Heat	Starting Pouring Temperature, °F.	Chemical Composition of Irons — T.C. %	Si %	Mn %	S %	P %
Low-Carbon, Untreated Iron Fig. 1	78-lb. Pig Iron 27-lb. Steel Scrap 14-lb. Washed Metal 0.123-lb. Iron Sulphide 0.43-lb. FeMn 1.35-lb. 75% grade FeSi	1 2 3	2350 2650 2950	3.04 3.08 2.95	2.15 2.15 2.18	0.69 0.72 0.76	0.064 0.062 0.064	0.091 0.094 0.093
Medium-Carbon, Untreated Iron Fig. 1	77-lb. Pig Iron 19-lb. Steel Scrap 24-lb. Washed Metal 0.124-lb. Iron Sulphide 0.44-lb. FeMn 1.0-lb. 75% Grade FeSi	1 2 3	2350 2650 2950	3.25 3.28 3.21	1.83 1.85 1.86	0.72 0.69 0.72	0.059 0.063 0.059	0.098 0.096 0.094
Low-Carbon Iron Treated with FeSi in Ladle Fig. 3	78-lb. Pig Iron 27-lb. Steel Scrap 14-lb. Washed Metal 0.43-lb. FeMn 0.123-lb. Iron Sulphide 0.55-lb. 75% Grade FeSi in Furnace 0.80-lb. 75% Grade FeSi in Ladle	1 2 3	2350 2650 2950	3.06 2.94 2.81	2.13 2.15 2.10	0.70 0.68 0.73	0.063 0.064 0.060	0.097 0.098 0.096
Low-Carbon Iron Treated with Calcium Silicide in Ladle Fig. 3	78-lb. Pig Iron 27-lb. Steel Scrap 14-lb. Washed Metal 0.43-lb. FeMn 0.123-lb. Iron Sulphide 1.03-lb. 75% Grade FeSi in Furnace 0.388-lb. Calcium Silicide in Ladle	1 2 3	2350 2650 2950	2.98 2.97 2.88	2.05 2.29 2.07	0.73 0.72 0.77	0.055 0.056 0.053	0.093 0.094 0.093

CINCINNATI

Prepares for

A·F·A

CONVENTION

COMMITTEES organized by the Cincinnati District Chapter of the A. F. A. are preparing the hospitality of the Queen City for those attending the annual convention of the American Foundrymen's association May 15 to 18. Foundrymen as well as equipment and supply manufacturers and dealers are serving on the various groups arranging for such features as plant visitation, ladies entertainment, annual dinner, golf, etc. The Cincinnati committees are under the direction of George A. Seyler Lunkenheimer Co., as general chairman, Ray J. Redmond, Buckeye Foundry Co., general vice chairman, Edward B. Hausfeld, Ohio Pattern Works & Foundry Co., general secretary, and Robert Frankel, Superior Pattern Works, general treasurer.

Plants Will Be Open for Inspection

Plant visitation committee, with Philip W. Cone, Cincinnati Milling Machine and Cincinnati Grinders Inc., as chairman, is arranging to have a number of plants available for inspection during the week. A wide variety of cast products are made in the Cincinnati district, thus adding to the interest in that important part of the convention program. A special feature of the plant visitation program will be the organized trip to the plant of the Cincinnati Milling Machine and Cincinnati Grinders Inc. on Monday afternoon May 15. No technical program has been arranged for that time, so that all convention visitors may participate in this general group works visit to the foundry, machine shop and training school of that company. More detailed information on the plant visitation program will be presented in the May issue of THE FOUNDRY, published well in advance of the convention.

The ladies entertainment committee, with Ray J. Redmond as general chairman, is arranging several unusual features for the ladies attending the convention. Cincinnati, recognized as a leader in music and art, offers many attractions which should be especially interesting to the ladies. A reception and tea will highlight the ladies' program on Monday, and the events for Tuesday and Wednesday will include visits to many points of interest in and around the city. The complete program of ladies entertainment likewise will be presented in the May issue.

Prominent Men on Committees

Convention committees of the Cincinnati District Chapter of the A. F. A. in addition to officers previously mentioned are as follows:

Reception Committee: Herman K. Ewig, Cincinnati Milling Machine Co., Cincinnati, chairman; John Hill, Hill & Griffith Co., Cincinnati, vice chairman; Karl A. Stein, Acme Pattern & Tool Co., Dayton, O.; A. H. Kramer, Advance Foundry Co., Dayton; Oliver L. Bardes, Bardes Range & Foundry Co., Cincinnati; Charles Wise, Buckeye Products Co., Cincinnati; Joseph F. Westendorf, Dayton Castings Co., Dayton; Earl H. Thompson, H. P. Deuscher Co., Hamilton, O.; Benjamin J. Kaufman, Edna Brass Mfg. Co., Cincinnati; Charles C. Erhart, Erhart Foundry & Machine Co., Cincinnati; William A. Haven, Haven Malleable Castings Co., Cincinnati; J. W. Freiberg, Ranschoff, Inc., Cincinnati; Henry M. Wood, W. W. Sly Mfg. Co., Cincinnati; S. C. Young, D. T. Williams Valve Co., Cincinnati; John W. Bolton, Lunkenheimer Co.

Hotel Committee: Harold P. Ritter, Oberhelman-Ritter Foundry Co., Cincin- (*Please turn to page* 78)

LIMITING of manganese in *specs* for cast steel to the author, always has been like a red rag to a bull. The A.S.T.M. specification, A87-36 for railroad castings, and M201-36 of the American Association of Railroads, limit manganese to 0.85 per cent. A.S.T.M. A27-36T for miscellaneous castings, and the American Railway Engineering association specification for castings for bridges, draw the limit at 1.00 per cent, the government specification following suit in the case of class O, common, (49Sli, class C, will probably be made to conform to the same limit).

One of the arguments for the adoption of these limits was that steel with manganese higher than 1.00 per cent is alloy steel, and should be purchased under an alloy steel specification, such as A.S.T.M. A148-36, (not included in this tabulation), which covers alloy steel castings for structural purposes. Of course, it generally is recognized today that steel containing more than 1.00 per cent manganese is an alloy steel, or at least a low alloy steel, so that there is some justification for the claim that it should be listed as such.

Better Than Lower Manganese Metal

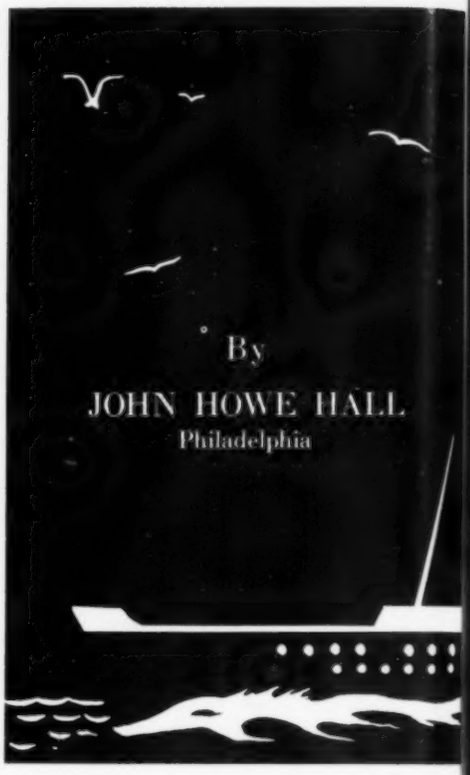
However, manganese is a cheap element, and it is often desirable, in meeting severe requirements for physical properties, to use more of it than in common practice. There is no question of the steel so made being of inferior quality, indeed it is widely recognized that it is of better quality in most cases than the lower manganese metal.

Why, therefore, if the maker wishes to use some of this relatively cheap alloy to make a heat of steel more surely meet requirements, should he not be permitted to do so, instead of imposing this ridiculous bar that says he may not furnish the better steel even if he feels he can afford to do so in the order in question, and is willing to incur the slightly higher cost?

No, says the specification, manganese above 1.00 per cent makes your steel an alloy steel, and you positively must not be allowed to furnish it under a carbon steel specification like me! There is no similar provision against the maker putting in any other alloy in some of these specifications, such as A.S.T.M. A27-36T. Under this and similar specifications I may use as much nickel or what-have-you as I please, and submit a low-alloy casting all I want to, as far as anything in the table of chemical requirements goes—but under no circumstances may I do the same thing with manganese, regardless of how good a steel I furnish.

One per cent is the deadline, and that is all there is to it. One is led to the uncharitable suspicion that the reason for the adoption of this clause is that an effort was being made some years ago to secure recognition of manganese steel as an alloy steel, entitled to the extra prices charged for alloy material, and if it were possible to obtain it in some cases under a carbon steel specification, it would weaken the argument in favor of the price differential.

Indeed when one of the A.S.T.M. specifications was



This article, and one which appeared in the March issue represent the personal views of the author, and are submitted by him entirely in his personal capacity and not as the representative of any society
—The Editors

under discussion, and the author objected to this restrictive clause, he was told privately that this was one of the compelling reasons back of the demand for restrictions on manganese, and that it was the part of all good foundrymen to shut up and go along. Being naturally stiff-necked and fond of his own opinion, the author could not see this point of view, and went down fighting.

A different and more reasonable motive governed the adoption of the manganese restriction, at least some years ago, in the case of the railroad specifications. Thus, a prominent railroad engineer some years ago told the author that he must recognize that the railroads had to be governed by their equipment and personnel in deciding such questions as how much manganese is permissible in their castings.

It is recognized, this man pointed out, that intermediate manganese steel castings to be at their best require either normalizing or quenching, both preferably followed by a draw, and that the properly heat treated material is made considerably less reliable if it is subject to some full annealing treatment. The railroads, said this man, are not manned

in their shops out through the country by men familiar with modern heat treatment practice, but most of the men who would handle castings in the repair shops would be of the blacksmith type.

Castings on cars sent in for repair, if bent or twisted out of shape, most likely would be straightened in the smith forge, and then given an old fashioned anneal. To guard against possible trouble from this sort of thing occurring, the argument was advanced that the manganese in railroad castings should be held down to such a point that there could be little if any loss of toughness resulting from such handling.

Argument Has No Justification Now

This argument did in fact have some justification a number of years ago, but today, with the enormous tonnage of intermediate manganese steel castings supplied the railroads for special purposes, often under fancy trade names, it does seem as if their personnel should be perfectly familiar with the material, and that the bars might be let down on manganese in general steel castings.

Of course, there is still an answer to this, to the effect that the railroader wants to know which castings it is that contain the high manganese, and if it is only present in those bought as intermediate manganese, there will be little possibility of mistake. Although that is rather a weak argument, it is probable that the manganese limits in specifications will persist for some years, ridiculous as they seem when one tries to analyze the arguments under which these clauses were adopted.

Leave Carbon Choice To Maker

Again, carbon restrictions are a form of *how* clause, and often an exceedingly troublesome one. Effect of variations in carbon, of course, is to raise tensile strength and yield point, and to lower elongation, reduction of area, etc. Why, then, not simply indicate in specifications the type of steel desired, as shown by its physical properties, and leave the choice of carbon content to the maker?

It will be seen that the A.S.T.M. and the railway associations take this attitude, with the trifling exception of A.S.T.M. specification A95-36, where a carbon range is specified. The limits called for, in A95-36 are so broad that they practically embrace the whole range of commercial cast steels, and the carbon requirement might as well be omitted entirely.

The government authorities, on the other hand, have fallen into the error of prescribing carbon limits as well as physical properties, and thus are specifying both what they want and how it is to be made. Some justification for this exists, perhaps, in classes 1 and 2 of QQS681a, and the (*Please turn to page* 82)

What Causes Scrap

This article is from a paper presented before the 1938 regional foundry conference held at Massachusetts Institute of Technology, Cambridge, Mass. The author is metallurgical engineer, Singer Mfg. Co., Elizabeth, N. J.

By
W. G. REICHERT

TO MAINTAIN a high quality product and to keep the cost of production and the percentage of defective castings at a minimum it is essential first to emphasize certain fundamental management policies which must be maintained. First consideration should be to investigate quickly and classify the cause of all complaints of defective castings. A classification of that kind tends to reduce losses because it places the loss in a position where immediate action can be taken for correction.

Records are of major importance to present the facts in any foundry. A permanent record of all test data should be kept for reference so that casting losses, whether attributable to sand, metal, molding or gating, may be checked constantly.

Plotting daily curves of permeability, strength and moisture against scrap losses caused by sand, such as blows, cuts, drops, rough, stickers, etc., have helped considerably in reducing casting losses in many foundries. Metal and molding losses are also classified, shrinkage, cold shuts and slag inclusions.

Many foundries have standardized gating methods and have established a card index system showing the gating of different types of castings that have produced satisfactory results. A system of that kind has been especially valuable when designing a gating arrangement or a new pattern.

A group of foundries definitely can agree on the same general type of sand, the same composition of metals and the same gating arrangement although located in different sections of the country. This question of standardization is especially important to companies having a number of foundries scattered over a wide area. Responsibility for the work on the correlation of test data and defective castings must be centralized. In the small foundry this may be accomplished by the foreman or superintendent. In larger foundries it is generally delegated to a qualified member of the foundry organization. In any case the responsibility for this work must be centralized.

Internal shrinkage or sponginess has been a major foundry problem since the first casting was made and still is the cause of thousands of rejects. Of first importance is the production of solid castings. High strength iron mixtures and the use of alloys play a very valuable part in the industry but these foundry tools are worthless until we learn and know how to produce solid castings.

Shrinkage often is a source of trouble in the foundry producing pressure castings, or in castings where thin and heavy sections adjoin each other and where it is impractical to change this condition.

Shrinkage Presents Difficult Problem

Shrinkage, gating, risering and design are closely interrelated and the solution of one often depends on the other. Shrinkage of the metal caused by difference in the cooling range presents the most difficult problem. Shrinkage problems can be corrected in many ways: By adequate gating of the mold; provisions for risers; regulating the gating and pouring practice which practically will allow the metal to set as fast as it is poured; equalizing solidification by the use of chills; changing the composition and therefore the solidification range of the iron. Individual problems in shrinkage often must be solved by a given set of circumstances which surround the casting. For example, we were making a casting having an abrupt change in section ⅜ to 2½ inches. We could not change the gating arrangement because of flask equipment. We could not reasonably change the composition of the iron because of machining speeds set up by the engineering department. Neither could we change the design. The heavy section was located in an inaccessible place where a riser could not function properly. The shrinkage cavity finally was remedied by a localized chill in the core. Circumstances generally dictate the method to be used in eliminating shrinkage cavities. Correction of shrinkage prob-

Losses?

lems is too complex to permit hard and fast rules to cover all circumstances and conditions.

In any discussion on internal shrinkage and defects the design of the casting should be given first consideration. We must stress the importance of close co-operation and association between the engineer and the foundryman. A drawing or the pattern should be submitted to the foundry for comments before it is placed in production.

It is desirable from a foundry standpoint to produce castings of a rather uniform metal thickness. This equalizes the rate of solidification and simplifies both the gating and the feeding. Nonuniform solidification sets up internal strains and causes shrinkage cavities, cracks and reduces strength. Wherever uniform thicknesses are impossible the changes in a section should be made with a gradual taper rather than abruptly. Adequate fillets at all intersections will reduce shrinkage and cracks, but the fillets should not be so large as to interfere with even metal sections.

Points to Causes of Shrinkage Cavities

Internal square corners are to be avoided wherever possible. A sharp corner readily may develop a minute check that will extend into a crack, particularly in the vicinity of the gates where the metal cools last. Losses due to cracks will be greatly lessened if the corners are slightly rounded.

Bosses and lugs common to many types of castings, if not properly compensated for, frequently will lead to shrinkage cavities. They should conform to the thickness of the adjacent section as closely as possible. Large holes requiring machined surfaces frequently are cored and later machined to dimensions. Often to avoid shrinks in bosses it is necessary to core out the holes. The (*Please turn to page* 88)

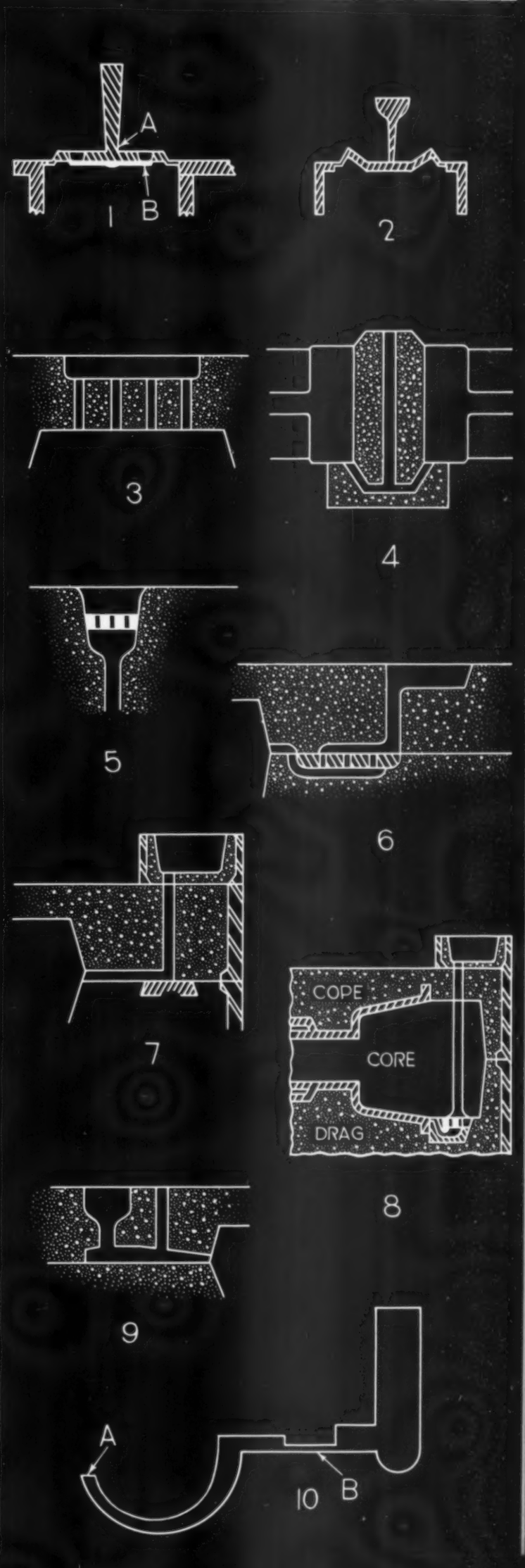


Fig. 1—Typical gating arrangement for stoveplate and other light castings. Fig. 2—Dirt catcher employed in light casting and automotive foundries. Fig. 3—Pencil gates force metal into cavity. Fig. 4—Bottom gate for hubs or gear blanks. Fig. 5—Strainer core dropped into sprue. Fig. 6—Strainer core set to more exact requirements. Fig. 7—Splash core. Fig. 8—Strainer core in dry sand bottom. Fig. 9—Relief sprue. Fig. 10—Horn gate

Nonferrous Foundry Has Wide Range Of Alloys Available

By N. K. B. PATCH

IN DEALING with the series of copper-tin bronzes, (THE FOUNDRY for March, page 30), whether deoxidized with zinc or with phosphorus the presence of impurities has an important influence. Iron in excess of 0.15 per cent will affect the hardness, increase shrinkage and consequently require risers to insure proper feeding of the castings. Lead above 0.30 per cent tends to reduce the ultimate tensile strength and affect elongation. Antimony in excess of 0.15 per cent tends to increase hot shortness of these alloys but otherwise is not a serious objection, unless the content reaches above 0.30 per cent, when casting difficulties may arise.

Presence of sulphur in excess of 0.05 per cent will tend to affect adversely the ultimate tensile strength and elongation. Silicon in excess of 0.01 per cent, or aluminum above 0.005 per cent will cause these alloys to leak under hydrostatic tests, and in the case of the bell metals will cause serious trouble in tone quality.

Manganese has been used as a deoxidizer in some copper-tin bronzes. It is added to the copper and stirred well until the manganese oxide resulting from the reaction of the manganese with the copper oxide has come to the surface. Then the slag is skimmed off the surface and the tin is added. This avoids oxidation of tin when added to the copper bath in crucible or furnace.

This practice has been used by some instead of adding phosphorus as a deoxidizer in an attempt to avoid troubles that might arise from presence of an excess of phosphorus in castings for certain types of service. However, there are few instances where a very small trace of phosphorus definitely has been proved detrimental in the alloys of the type now under consideration. In these copper-tin bronzes, it frequently is desirable to have a definite percentage of phosphorus present to give maximum hardness, although this tends to increase brittleness.

For certain services it has been found eminently desirable to have upwards of 1 per cent phosphorus in such alloys as composition *MM* or composition *NN*. Some of the bearings used in Europe are made from compositions containing high tin and relatively high phosphorus up to say 0.75 per cent, or even as high as 1 per cent phosphorus, and their resistance to wear under certain specific conditions definitely has been satisfactory in spite of the fact that these bearings were low in elongation.

The group of compositions as listed from *PP* to *ZZ*, (THE FOUNDRY for March, page 84) inclusive, might be termed leaded copper-tin bronzes, or leaded bronzes as differentiated from the previous group of copper-tin compositions which contained no lead, and also from those which follow, known as copper-tin bronzes that contain marked quantities of lead and might be termed high-lead bronzes. These leaded bronzes are a series of compositions illustrating the more common bearing alloys and embrace a wide enough variety to supply almost any demand that might arise in the industrial use of bearing bronzes.

In composition *PP* we have a lead bronze with what might be termed high nickel (3½ per cent). This composition differs from some of the others in this group in that it contains no zinc, and while there is no phosphorus demanded, it generally is produced by deoxidizing the copper with a small percentage of phosphorus. The percentage of phosphorus should be small enough so that practically none is present in the final alloy.

A trace of phosphorus is almost universally expected so that a sufficient amount shall be present to insure complete deoxidation of the alloy. This composition is very sensitive to gassing during the process of melting and, therefore, must be melted properly in the right atmospheric conditions. In fact, the entire series of alloys from *PP* to *ZZ* are easily gassed during melting if the furnace atmosphere is not correctly maintained at a slightly oxidizing point.

Composition *PP* is used regularly for heavy duty worm gear service and bearings where both strength and wear resistance are important, but it must be used intelligently and lubrication must be maintained if best possible results are to be secured.

While Table III does not indicate the presence of phosphorus in composition *QQ*, it like the previous composition is produced regularly by deoxidizing with phosphorus during the process of manufacture and almost always will indicate a trace of phosphorus in the resulting alloy. It is an excellent bearing metal, requires most careful manufacture and should be controlled carefully regarding the presence of impurities. (*Please turn to page* 93)

AMONG DETROIT FOUNDRIES

By A. H. ALLEN
Detroit Editor, The Foundry

FOR the past few years, brake drums made by Kelsey-Hayes Co. have been of the composite type, a pressed steel back and hub onto which is cast a gray iron flange or drum. The backing plate usually of about 0.100-inch thickness is formed with ears or small holes around the outer circumference to permit secure anchorage of the cast iron flange. Thickness of the latter usually is in the range of 0.330-0.370-inch.

Three complete drum casting units are operated. The largest has six pairs of molding machines for copes and drags. The intermediate line has three pairs of machines and the smallest unit has one pair used chiefly for production of the larger size truck drums.

Using cast iron patterns, the copes and drags are rammed mechanically, two drums per mold, and are rolled out to the main conveyor line on roller tables at right angles to the main line. As the drags move along the line, workmen place the steel backing plates accurately in position. Copes are then lowered into position with air hoists and the molds travel down the line to the pouring station. The molds are poured through a sprue at the center, the iron flowing through a baked core sand strainer and then into the outer edge of the drum flange.

New Sand Steadily Added

Since the molding sand is used repeatedly, it is necessary to make up for that which clings to the casting after shakeout. New sand in small amounts is added to the system usually just after the molds have been poured.

Iron is melted in a cupola, with a second cupola in reserve. Charge for brake drum iron usually contains 35 per cent pig iron, 35 per cent scrap and 30 per cent returns. Iron is tapped at 2850 degrees Fahr. into 800-pound pouring ladles suspended from a monorail system. About 3 minutes elapse between the time the ladles are filled and their contents transferred to molds. One ladle usually fills about 20 molds. With production on the largest unit running about 400 molds per hour, it is apparent that heavy traffic of ladles between pouring stations and cupola is a necessity. The monorail system is so designed that ladles can be tracked around the system at will, with little interference.

Where specifications call for alloy content, it is added just as the iron is tapped from the cupola into the ladle. Copper, chromium and nickel are most common, alloying agents, copper being added to the amount of 0.75 per cent in one specification. Total carbon content approximates 3.35 per cent, silicon 2.50 per cent.

Molds proceed along the floor conveyor to a shakeout station, with 20 minutes time between pouring and shakeout, an interval determined carefully to produce the desired qualities in the finished drums. Brinell hardness of the iron in the finished products, ranges between 187 and 217, usually being close to 200.

Separated on Vibrating Grid

At the shakeout station, an air hoist removes the cope and castings from the mold. The copes are turned over by hand and the castings descend on an inclined vibrating grid to a conveyor. The attendant impact is sufficient to break off gates and risers which are placed on a separate conveyor and carried to the storage yard outside the foundry building.

Transferred to an overhead hook conveyor the drums are carried first past an inspection station where small fins and other adhering pieces are broken off. Then they pass to a battery of twin-wheel floor grinders where the gates are ground off to the diameter of the flange and then the drums are returned to the conveyor which transfers them to the shotblast.

The drums pass through a continuous and automatic shot blasting booth where all surfaces are cleaned. Next is an inspection station where each drum is examined visually (*Please turn to page* 96)

QUESTIONS and ANSWERS

Lead in Bronze Alloy Tends To Drop or Segregate

We have been making bushings and bearings from the following alloy: Copper 82 pounds, lead 15 pounds, tin 8 pounds, zinc 2 pounds, and monel 2 pounds, adding a small piece of 15 per cent phosphor-copper. We use a flux consisting of 25 per cent sodium sulphate, 45 per cent plaster of paris, 20 per cent sodium chloride and 10 per cent calcined borox. One per cent is added to the cold charge and 1 per cent after the metal is molten. Sometimes the castings are good, but in many cases the lead drops or segregates. We would appreciate your opinion on how to overcome that difficulty.

If your alloy is not specified and may be changed, you will get better results by avoiding both zinc and phosphorus in the same alloy. Both are deoxidizing agents, whereas a high lead alloy will suspend the lead better if there is some copper oxide present.

Some produce high lead alloys by adding powdered copper oxides to the alloy before adding the lead. You evidently depend for the suspension of lead upon the sulphur derived from the flux used. A great deal of trouble in suspending only 15 pounds of lead, or 13.76 per cent, really should not be encountered in an alloy of copper and tin of the proportions you describe. Melted in an atmosphere relatively free from underburnt gases, high enough in oxygen to reduce to a minimum those gases and give the maximum combustion conditions, you should have no trouble. There will be trouble from the presence of both phosphorus and zinc in the alloy, it being well known that alloys containing both of these do give some trouble in the form of pin holes and drossy spots in the castings.

By adding 2 pounds of monel metal you are adding about 1.25 per cent of nickel. This raises the melting point and makes the matrix in which the lead is suspended solidify at a higher temperature when the alloy cools. This commonly is resorted to as a means of suspending lead. We believe there was a patent some years ago issued for an alloy in which the lead was suspended by having a nickel content present to raise the temperature at which the alloy solidified. This imprisons the lead in the matrix before it has a chance to accumulate in large globules, after which the lead itself solidifies.

You should have no trouble even though you use nickel and a sulphur producing flux if you do away with the phosphorus and at the same time melt the metal rapidly in an atmosphere that is definitely oxidizing rather than reducing. When this metal is melted to the temperature of pouring, it should be poured at once and not allowed to stand around waiting the completion of molds.

Describes the Manufacture of Calcined Clay or Chamotte

We are doing some experimental work with calcined clay molds for special steels and would like to inquire if you have any data on the use of that material, how it is mixed, etc.?

Calcined clay is called chamotte, and some very detailed information on that subject was given by Briggs and Gezelius in an article in the November 1933 issue of the *Journal* of the Society of Naval Architects. About the same time and in the same journal, Capt. Louis Shane, U.S.N. presented an article on European foundry practice which also referred to use of chamotte.

As described by Briggs and Gezelius, the practice is to calcine a highly aluminous clay at 1500 degrees Cent., and to mix 85 per cent of that calcined material with 15 per cent raw clay. The resulting analysis varies between 31.75 and 42.69 per cent alumina, 54.78 to 63.5 per cent silica, and 1.15 to 2.5 per cent iron oxide. The fusion point as measured by seger cones is 1750 to 1770 degrees Cent. (3180 to 3220 degrees Fahr.). The fineness of chamotte as described by Briggs and Gezelius is 20 per cent on screen 12, 54 per cent on screen 20, 4 per cent on screen 28, and 14 per cent clay bond. It is quite a coarse material with very high permeability. It is best mixed with 5 to 8 per cent water; too much makes it sticky and unworkable.

Several shops use the new chamotte for facing with reworked chamotte for backing. Some shops mix in fine silica sand to get smooth surfaces. For a wash, they usually empty finely pulverized chamotte. Briggs and Gezelius report the results of numerous experiments with that material to determine strength, openness, etc., but say little about how it worked in making castings.

Chills Must Be Dry and Clean To Prevent Difficulty

We have had considerable trouble with perfectly clean blow holes around chills in aluminum castings. This applies both to small pin shaped chills stuck in the green sand surface, or large 4-pound special chills which rest on chaplets.

From your description we are inclined to the opinion that the blow holes are caused either by an oxide film or dampness on the chills, or possibly by a combination of both. Even on iron castings the chills must be clean and dry to prevent the formation of blow holes. Aluminum is much more sensitive than iron, therefore extra precaution must be taken to see that the chills are perfectly dry and clean. Clean the surface thoroughly and then either dip the chill or spray it with kerosene or gasoline. The chills should not be left in green sand molds more than an hour or two before the molds are filled with metal.

Cast Iron Bushing May Be Cast By Centrifugal Process

We are making cast iron bushings 7 inches outside diameter and 2 inches inside diameter approximately 7 inches in length. On many of these the inside has to be chilled. We are contemplating pouring these castings in an upright position while the mold is rotating. The object is to throw foreign material, dirt, slag or sand away from the inside surface. Could you tell us who makes a rotating device for this purpose and the approximate speed at which the mold should revolve.

Your request for information is based on a mistaken assumption. Centrifugal action throws the *heavier* material, and not the lighter to the outside. Hence, if you were to adopt this process in the production of your bushings you would have a concentration of dross on the inside, thus defeating the object you have in mind.

Bushings and similar castings are made in a few places by the centrifugal method, both in a vertical and horizontal position. The castings show a closer grain than castings from a similar composition poured in the ordinary manner. Another advantage is that no cores are required. The outside surface is clean and smooth, but the inside surface usually requires a considerable amount of machining or grinding. Certainly not the kind of surface you have in mind, or the kind you secure at present by the use of chills.

Bronze Bearing May Be Poured At Too High Temperature

We are forwarding a half bearing for a 4½-inch shaft. It is made from an alloy containing 80 per cent copper, 10 per cent tin, and 10 per cent lead, purchased in ingot form and melted in an open-flame, oil-fired furnace. The interior and exterior surfaces of the bearing are filled with minute fissures, and on the exterior surface where pieces have been torn out during machining, the fractures seem to be discolored. The metal was poured at about 2100 degrees Fahr., and from the same heat perfect castings consisting mainly of bushings were poured. The trouble comes and goes from time to time.

We believe you are pouring your metal at too high a temperature. This seems to be borne out by the statement that perfect castings are obtained from the same heat. Evidently the casting temperature is judged by eye, and that is far from an infallible method. It will pay in the long run to purchase an immersion type pyrometer to know the actual pouring temperature. Also, try different pouring temperatures and determine the one which gives the best results. Then standardize on that temperature.

Presumably the 80-10-10 alloy is deoxidized with phosphor-copper or phosphor-tin, using only a small amount for that purpose. The usual pouring range for that condition is from 1900 to 2050 degrees Fahr. If the phosphorus content is such that from 0.10 to 0.20 per cent remains in the alloy, the pouring range is decreased to 1840 to 1900 degrees Fahr., and when from 0.50 to 1.0 per cent phosphorus is in the alloy, the range drops to 1500 to 1680 degrees Fahr.

Latest air view of the New York World's Fair which will open on April 30. The view was taken from Fountain lake looking north. Directly across from the lake in the foreground lies the main exhibit area dominated by the perisphere and trylon

Plumbing Appliance Cores Too Soft

We are forwarding three brass castings—a by-pass valve, the lavatory faucet and the drain *T*—and will appreciate your opinion on the cause of the defect in each one. The castings are molded in Albany sand No. 1½ and the cores are made from a mixture of 2 parts Michigan City sand and 1 part bank sand bonded with raw linseed oil. Metal in the castings is an alloy containing: Copper 83 per cent, tin 4 per cent, lead 6 per cent, zinc 7 per cent. Pouring temperature is between 2100 and 2150 degrees Fahr. The cores are blown out in water in the usual manner.

Outside appearance of the castings shows that the molding and gating practice are quite satisfactory. However, the interior surface and the sections where the castings have been broken for inspection indicate definitely that the core practice needs attention. The sand mixture conforms to the usual standard for this class of cores, but the evidence seems to indicate carelessness or lack of skill on the part of the coremaker. The cores are too soft and at several points are not properly joined. Presumably they are made in half coreboxes or booked.

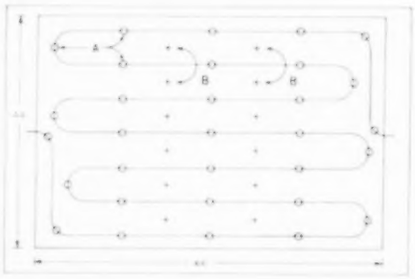
As a result, the metal seeps in between the grains of sand on the surface and into the joint between the halves of the core. This accounts for the rough surface and the fins on the inside of the castings. The entering stream of metal washes away some of the crumbling fringes and forms a drossy combination which floats a certain distance and then becomes anchored either to the core or mold surface. The obvious remedy is to ram the cores a little harder and see that the joints of the two halves touch each other properly and completely. Due to the comparatively high temperature at which the metal must be poured to properly fill all the molds in a flask, also on account of the comparatively high lead content—6 per cent—this metal has a searching effect—it may be advisable to dip the cores in blacking to provide an impervious coating.

To Cast Pipe Coil In Large Plate

We have an inquiry for a slab casting shown in the accompanying sketch 3 inches thick, 44 x 66 inches with a ¾-inch pipe coil cast in the center. What procedure is required to prevent the pipe from burning or fusing.

Provided the extra heavy hydraulic type pipe coil is properly made without cracks or splits it does not require to be filled with sand or any other material to resist the heat or pressure of the molten iron. The only really important feature is the extra chapleting required to prevent the pipe from buckling during expansion. If the pipe is not properly supported on both sides it will shift position and in extreme cases will *cut through* either on the top or the bottom.

If it does not come all the way through it will depart to some extent from a straight line and therefore, will not be truly in the center. This factor may or may not affect the utility of the casting in the purpose for which it is intended. The casting should be gated in a manner that will prevent a stream of iron from impinging directly on the coil. This can be done by gating at opposite corners at both ends with the streams entering between two coil members. A better method and one that will fill the mold in a minimum time is to pour the metal through a number of small pop gates extending in two lines across the center as indicated at *B* in the accompanying sketch and connected to a long basin on top of the cope.



Suggested gating system shown at B, and chaplets shown at A

For one or two castings a set of special chaplets may be prepared with saddle heads. The pipes will expand ¾-inch and provision must be made for this expansion in a longitudinal direction. Conceivably with a plain flat head, the pipe might slip off the chaplet. If the method did not affect the utility of the casting, flat strips of steel ½ x 1½ inches might be used to support the coils top and bottom. In that case three chaplets in a line instead of the seven as shown at *A* on the sketch will be sufficient. Where the mold is made in green sand, long stem chaplets will be required. In a dry sand or loam mold, stud chaplets may be substituted. To prevent blisters, dirt and blowholes on the upper face of the casting the pipe must be cleaned thoroughly and covered with a protective coating, usually ordinary red paint. A riser at each of the four corners will allow the extra gas to escape.

Blowholes Occur in Bearing Alloy

We have occasion to cast considerable tonnage of 50 per cent copper, 50 per cent lead mixture. We have experienced difficulty with blowholes with this metal in sand castings. We have tried a chill plate drag and a sand cope without much improvement. Castings from the chill drag are of a much better grain structure and we are anxious to continue the practice.

Castings of 50 per cent copper. 50 per cent lead alloy should give little trouble from the standpoint of blowholes, except close to the surface of the casting, where small blowholes are exhibited just under the skin. Many manufacturers accept that as a necessary evil and design their patterns so that a sufficient amount of metal is removed in the process of machining to eliminate the defects. There is no necessity for having such small defects if care is taken in the production of the castings.

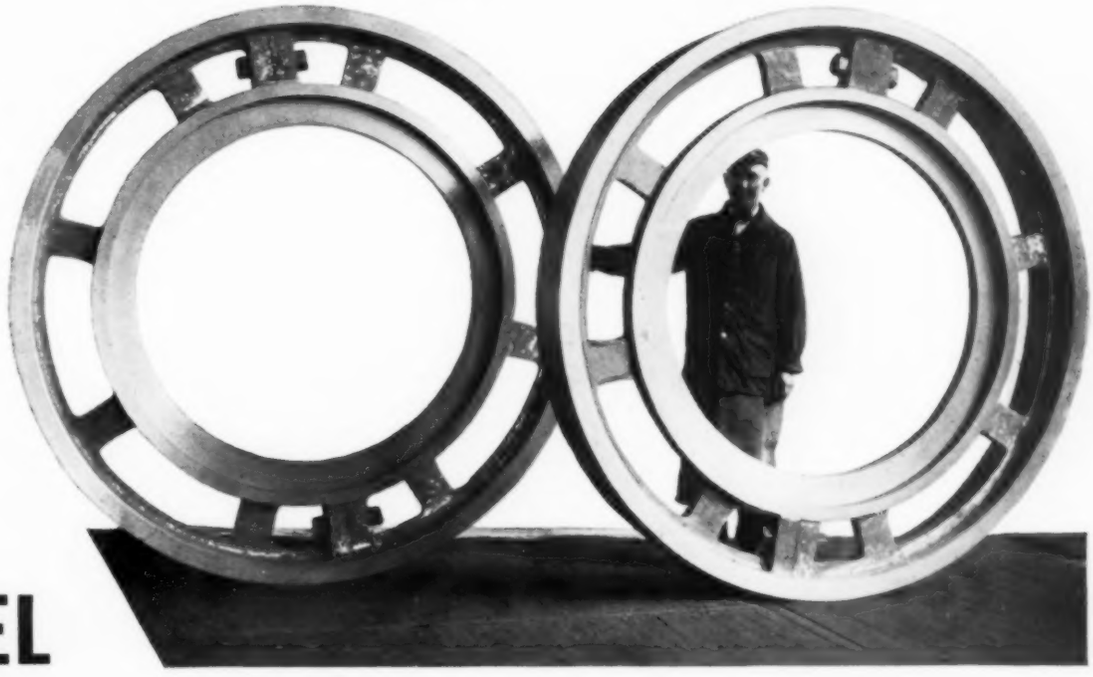
Since this metal is poured at a relatively low temperature and naturally is somewhat less fluid than other similar alloys that are cast, gases entangled in it from blows from the sand or cores do not pass out readily. However, if the temperature is raised so as to increase fluidity, gas absorption during melting is more likely and burning into the sand is more aggravated. Consequently, general practice indicates pouring at a comparatively low temperature.

A chill drag is good practice if the metal is led into the mold quietly and the drag is warm when the metal enters. A cold metal drag will give serious trouble, particularly if the cope is green sand. Good practice has developed the use of warm metal drags and dry sand copes. These dry sand copes should be made of an open sand but carefully blacked so that the metal does not burn into them and make a rough casting. Given a mold that will not develop gases and form the source of bubbles in the castings, the next step is to have the alloy itself free from gases which have been absorbed during the melting process. This means rapid melting and the best furnace practice.

We believe that some of your trouble may come from exposing your alloy to furnace gases for an excessive period. When that alloy has reached the proper pouring temperature, it should be withdrawn from the furnace at once and poured into the mold. If you are using sand molds, they should be well dried, and where chilled molds are employed, they should be heated previously to drive off all moisture.

Do you get "COLD CHILLS" when casting BIG GEAR BLANKS?

You'll take pride in perfect castings like these 8' gear blanks, produced by Bagley and Sewall from even textured Nickel iron. These gears are also produced of Nickel-chromium alloyed cast iron.



...NOT WHEN YOU USE

NICKEL

These gears were made by Bagley and Sewall Co., Watertown, N. Y. of an alloy cast iron containing 1.50% Nickel and 0.75% chromium. They are used to drive pebble mills.

WHEN casting gear blanks, large or small, the use of a nominal amount of Nickel is the cheapest insurance against producing an unsatisfactory gear.

The ability of Nickel to eliminate chilled corners and edges and equalize the structure in widely different sections is well established. This important contribution is reflected in more satisfactory machinability and lower tool costs by your customer.

Density at the roots of cut teeth is assured in a properly balanced Nickel alloyed cast iron, thus avoiding the possibility of expending foundry and machining time on a gear which finally must be rejected.

Your customer's good will is important. You can retain it through the simple and inexpensive use of Nickel.

Assistance in solving your foundry problems on gears and other castings will be freely rendered if you will communicate with the address below.

NICKEL CAST IRONS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

MEN of INDUSTRY

HOMER BRITTON recently was elected vice president and general foundry manager, Cleveland Co-Operative Stove Co., Cleveland, as a climax to 26 years of service to that company. Mr. Britton's career with the stove company began with his work as general office clerk from which position he progressed through those of timekeeper, and assistant foundry manager. In 1919 when the new foundry was built, Mr. Britton was made foundry manager. Since that time he has been in charge of the largest stove plate foundry under one roof in the United States.

♦ ♦ ♦

HERMAN K. EWIG, general foundry superintendent, Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, recently was elected chairman of the newly formed Cincinnati District Chapter of the A. F. A. Mr. Ewig was born in Springfield, Mass., in 1897. Following completion of his education he became associated with Bauch Machine Tool Co. in the pattern shop. In 1918 he became connected with the milling machine company as a pattern maker. This was followed by experience as pattern shop supervisor, general experience in the foundry and in 1930 he was made general foundry superintendent. Mr. Ewig has been interested in the work of the A. F. A. for many years.

♦ ♦ ♦

CHARLES I. RITCHIE, Cleveland, recently was designated executive secretary of the Gray Iron Founders' Society, Inc., by the board of directors. Mr. Ritchie has had a wide experience in the gray iron foundry field and in foundry cost accounting and plant engineering. He has been a member of the staff of the Gray Iron Founders' society for the past 5 years.

♦ ♦ ♦

DANIEL G. BURKERT, recently elected president of the Eastern Foundry Co., Boyertown, Pa., succeeding the late Edwin M. Rhoads, has been affiliated with the foundry industry for the past 49 years. Mr. Burkert was graduated from Pottstown Business college in 1909 and a short time later began working for the Union Mfg. Co., Boyertown. He resigned in 1918 to join the Sanitary Co. of America, East Greenville, Pa., as plant manager. In 1922 he became one of the incorporators of the Eastern Foundry Co. and has served as vice president in charge of production, and purchasing agent.

♦ ♦ ♦

SWEN G. PULSON recently was added to the European staff of the Norton Co., Worcester, Mass. Mr. Pulson will make his headquarters in Sweden and will work with Norton distributors in Sweden, Finland, Norway and Denmark.

♦ ♦ ♦

DR. ALBERT RAY OLPIN, recently was appointed director of industrial research and field director of the Engineering Experiment station, Ohio State university, Columbus, O. to succeed the late Hurlbut S. Jacoby.

♦ ♦ ♦

RALPH NOLAN, 429 Citizens & Southern National Bank Building, Atlanta, Ga., has been appointed representative in Tennessee, Alabama, Mississippi, North Carolina, South Carolina and Florida for the Cleveland Quarries Co., Cleveland.

♦ ♦ ♦

WALTER B. SLATERY, formerly in charge of sands and washes at Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., and later sales engineer for the S. Obermeyer Co., Chicago, has been appointed sales representative for the foundry materials manufactured by the Casein Co. of America, 350 Madison avenue, New York.

♦ ♦ ♦

FRED L. CURTIS, Jackson, Mich. representative of the Norton Co. has

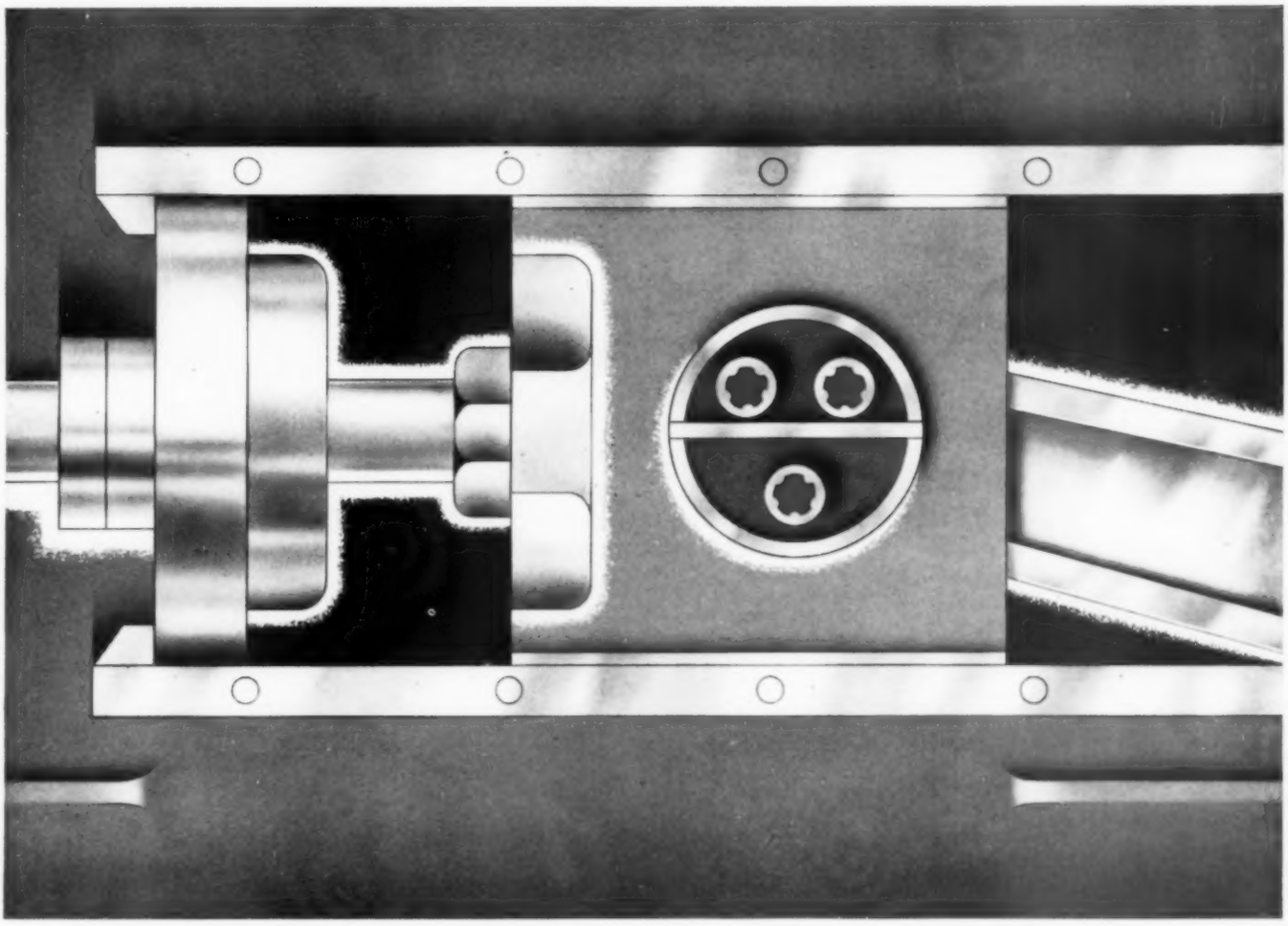
(*Concluded on page* 42)

Homer Britton

D. G. Burkert

C. I. Ritchie

Herman Ewig



MAKING PRODUCTION DOLLARS S-T-R-E-T-C-H

The simplification or elimination of fabricating processes is one way of making production dollars go farther. Molybdenum steels are often a help in that way.

For instance, a manufacturer of high pressure motor driven pumps uses cast Nickel-Molybdenum steel for cross-head guides because it has the required toughness and hardness. In addition, the ready machinability and close grained structure of the steel make it possible to produce a good bearing surface in the guide runways by a light cut with a shearing tool. One finishing operation — grinding — is entirely eliminated.

Rechecking your own material specifications may reveal places where Molybdenum steels will produce better results, or lower costs, or both. Our technical book, "Molybdenum in Steel," will be sent free to any interested production executive or engineer who requests it.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

Climax Mo-lyb-den-um Company
500 Fifth Avenue · New York City

MOLY

(*Concluded from page* 40)

been transferred to Detroit to succeed PAUL BROWN who is to be resident manager, Australian Abrasives Pty. Ltd., Sydney, Australia. S. J. BELL, office manager at Detroit will handle the Jackson territory and Milton J. Cowan, formerly of the home office, Worcester, Mass., will become office manager at Detroit.

♦ ♦ ♦

LOUIS G. TARANTINO, eastern representative for Niagara Falls Smelting & Refining Corp., Buffalo, recently was re-elected to serve his sixth year as secretary of the Connecticut. Nonferrous Foundrymen's association. Mr. Tarantino was born in Derby, Conn. and was educated in the schools of Shelton, Conn. After graduating from high school he traveled 5 years in the Middle West for the Naugatuck Valley Crucible Co., Shelton, later merged to form American Crucible Co. The following 3 years he represented the Bay State Crucible Co., Taunton, Mass., and in 1930 became connected with the Niagara Falls Smelting & Refining Corp. as their Eastern representative.

♦ ♦ ♦

FRED GROTTS, formerly vice president in charge of heat and corrosion resisting alloys, Chicago Steel Foundry Co., Chicago, has been elected president and director of the Fort Pitt Steel Casting Co., McKeesport, Pa., succeeding the late C. S. Koch. Mr. Grotts attended the universities of Illinois and Missouri, graduating from the latter with a bachelor of science in metallurgy and a master's degree in metallurgical engineering. He has been affiliated with Curtis Aeroplane & Motor Corp., Buffalo; Caterpillar Tractor Co., Peoria, Ill.; and American Steel Foundries, Granite City, Ill. He was connected with the Continental Roll & Steel Foundry Co., Chicago as metallurgical director for 7 years and then was vice president of the Lebanon Steel Foundry Co., Lebanon, Pa.

Mr. Grotts is a member of the American Foundrymen's association, the American Society for Testing Materials, and the American Institute of Mining and Metallurgical Engineers.

♦ ♦ ♦

HOWARD A. PHELPS, manager, Phelps Foundry Co., Ansonia, Conn. recently was re-elected president, Connecticut Nonferrous Foundrymen's association. Mr. Phelps is a native of Ansonia and graduated from Yale university in 1914. Following graduation he was a chemist with the Pennsylvania Salt Mfg. Co., Wyandotte, Mich., until 1917 when he went overseas. Returning from the war, Mr. Phelps joined his father in Phelps Foundry Co. which was established in 1898 and has been in operation since that time. Mr. Phelps was the first secretary of the Connecticut Nonferrous Foundrymen's association when it was organized in 1931, later becoming treasurer, vice president and now serving his second term as president of the group.

♦ ♦ ♦

George Robert Delbart has been named author of the French exchange paper to be presented at the annual A.F.A. convention in Cincinnati in May. Mr. Delbart was born in 1899 in the north of France and from the age of 15 he pursued his studies under serious difficulties, owing to the fact that he lived in the occupied regions of France during the war, which section he afterwards evacuated. Mr. Delbart received his degree as master of science and at the same time graduated as chemical engineer from Lille university in 1921. After spending some time investigating the heavy industries of the Liege district, Belgium, he took his first position as manager of the laboratory with Societe d'Escaut et Meuse, a tube works at Anzin in the north of France. In 1926 he received his degree as doctor of science at Lille university and after some research work both at the university and the work's laboratory, took the post of director of control and research work at Etablissements Cail, Denain, in 1927. In 1929 he was placed in charge of the steelworks and steel foundry of the concern and eventually became chief engineer of the technical services. Mr. Delbart has published more than 50 papers and articles on metallurgical subjects. He presented the French exchange paper, "A Study of the Industrial Application of the Martensitic Transformation of Austenitic Iron" at the A.F.A. convention in 1935.

♦ ♦ ♦

DAY E. CUTLER recently has been appointed sales manager, J. S. McCormick Co., Pittsburgh. Mr. Cutler has been associated with that company for the past 5 years and formerly was with General Electric Co.

♦ ♦ ♦

C. H. BUTTERFIELD recently has been appointed vice president and general sales manager of the industrial and railroad divisions, Manning, Maxwell & Moore, Inc., Bridgeport, Conn. to fill the vacancy caused by the death of W. P. Bradbury.

♦ ♦ ♦

SHELDON V. WOOD, manager, Minneapolis Electric Steel Castings Co., Minneapolis, recently has been elected to the board of regents, University of Minnesota. Mr. Wood was born in Jefferson, Iowa, received his education in the schools of that city and graduated from the University of Minnesota in 1904 as engineer of mines. He started his business career as mining engineer with Butler Brothers, contractors, Hibbing, Minn. From 1905 to 1907 he was an engineer with Great Northern Railway, St. Paul, and then was a sales engineer, Olds Gas Engine Co., Lansing Mich., from 1907 to 1912. He was a sales engineer with Gilson Mfg. Co., Port Washington, Wis. in 1912 to 1913. Since that time he has been manager, Minneapolis Electric Steel Castings Co.

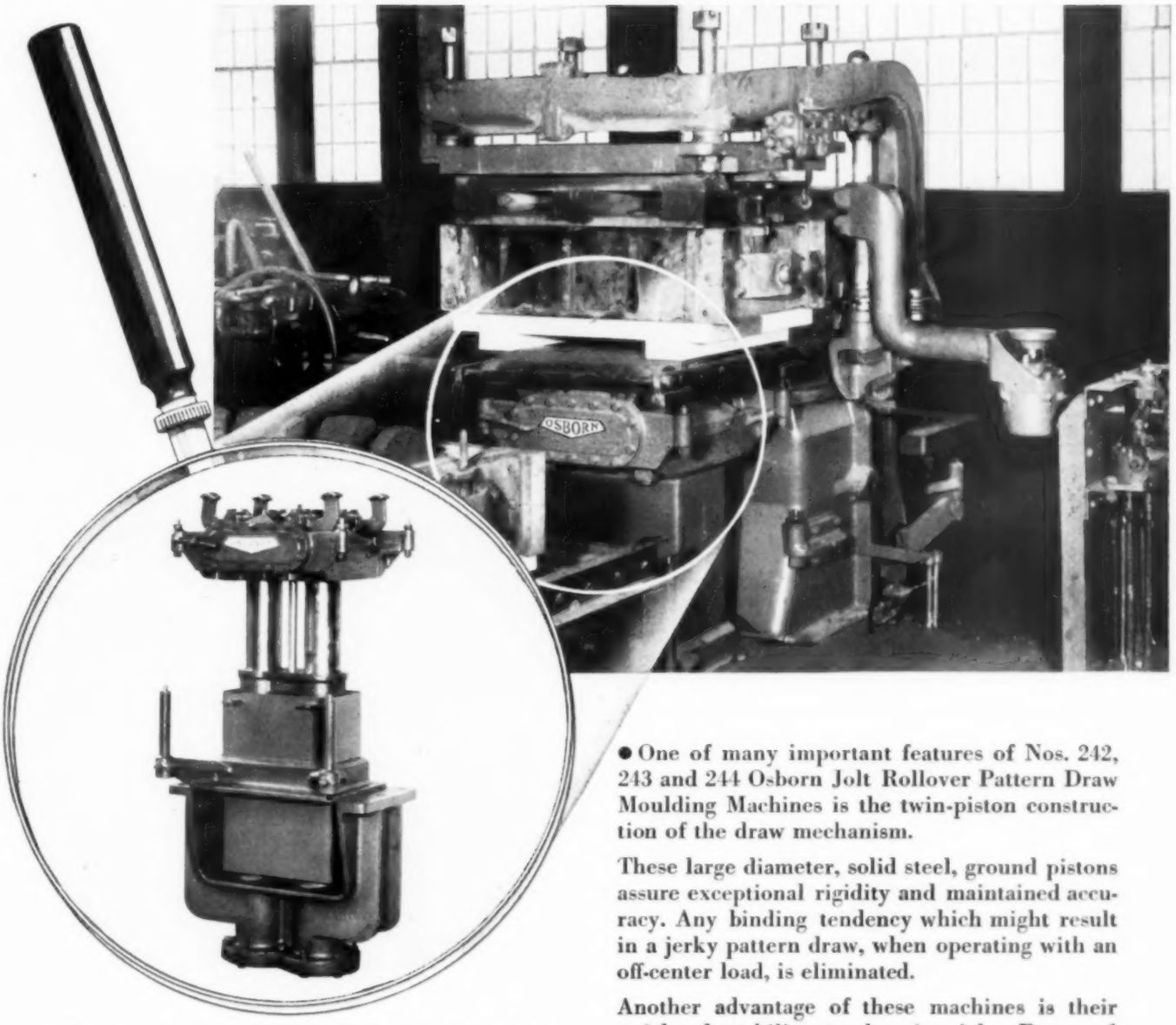
Louis G. Tarantino

Howard A. Phelps

George R. Delbart

Fred Grotts

TWIN PISTONS MAINTAIN ACCURACY



Above view shows the "twin-piston" construction of the draw mechanism in Nos. 242 (small size); No. 243 (intermediate size); and No. 244 (large size) Osborn Jolt Rollover Pattern Draw Moulding Machines.

THE OSBORN MANUFACTURING COMPANY
5401 HAMILTON AVENUE • CLEVELAND, OHIO, U. S. A.
Agencies located strategically all over the world

● One of many important features of Nos. 242, 243 and 244 Osborn Jolt Rollover Pattern Draw Moulding Machines is the twin-piston construction of the draw mechanism.

These large diameter, solid steel, ground pistons assure exceptional rigidity and maintained accuracy. Any binding tendency which might result in a jerky pattern draw, when operating with an off-center load, is eliminated.

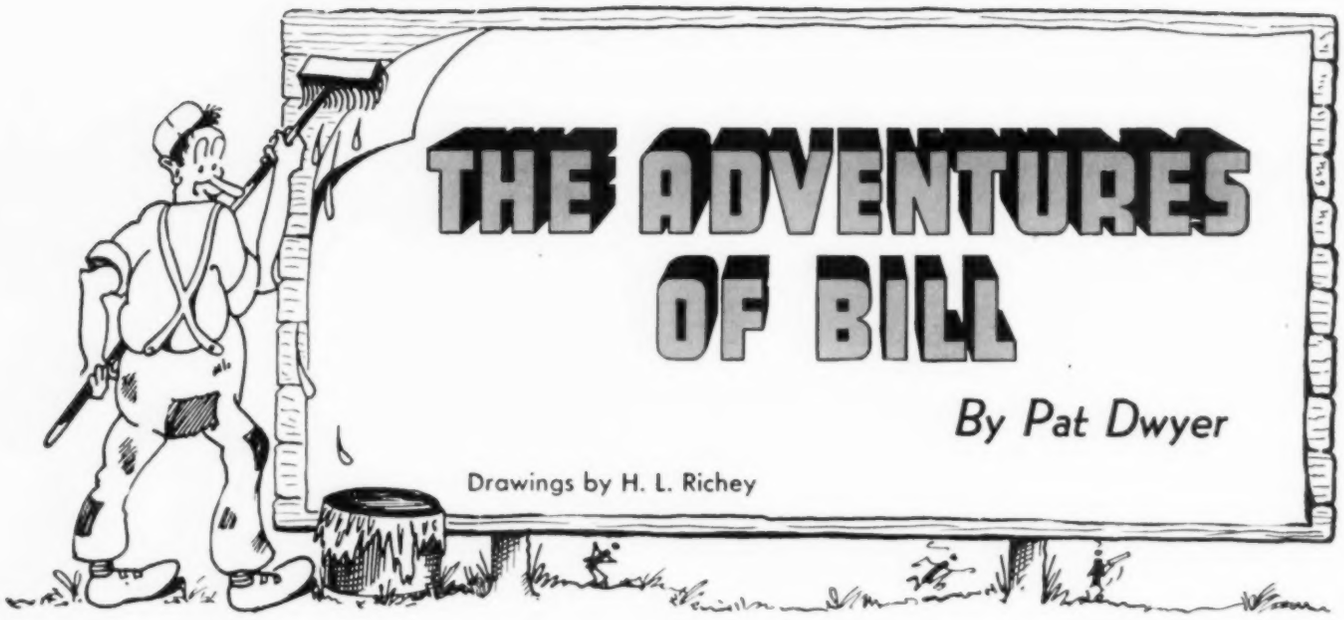
Another advantage of these machines is their quick adaptability to changing jobs. Easy and quick adjustment of draw stroke to conform to required flask depth is made by turning adjusting nut until figure on scale at indicator point corresponds to flask space required.

Investigate the many additional features of these machines which are particularly suited to jobbing and semi-production work.

TIME PROVES VALUES

OSBORN

MOULDING MACHINES



THE ADVENTURES OF BILL

By Pat Dwyer

Drawings by H. L. Richey

HAVE you ever had any experience," Bill inquired the other night, "in jails and penitentiaries, or with the people, the inmates, the raw material you might say who or which keep the wheels of these dingy institutions spinning merrily through all the four seasons of the year?"

"Meaning, am I a jail bird?"

"Not necessarily. Keep the old toupee reefed down, a free and easy nautical expression for the more familiar keep your hair on. Lots of people, highly respectable people, lawyers, judges, doctors, welfare workers and ordinary citizens have occasional contact with men who for one reason or another have been put away in the pokie. All I ask is a plain, simple question."

"All you get is a plain, simple answer and that answer is NO. Up to the present I have been fortunate enough never to have seen the inside of a jail. You probably will say that I may have the opportunity later, but I am not crossing any bridges until I come to them. Where does that leave you my dear young fellow? Why jolly well behind the eight ball and you can lay to that."

"Listen," said Bill, "You have me all wrong. I got mixed up to some extent with one of these here now pokie birds a few weeks ago—"

"What were you in for?"

"Who, me? I was not in for anything. Perhaps I had better start at the beginning."

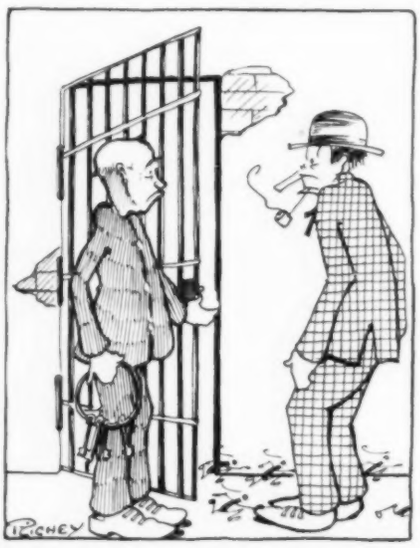
"I have heard that in certain quarters the method is considered quite sound. Personally I always have rather favored the idea. Seems to me I can get a better grip on a story when the author starts at the beginning, instead of shouting 'Help, Help!' and then back tracking for several chapters to explain what all the yowling is about. How did you get mixed up with this lad in the short hair cut and the cross bar suit?"

"Well," said Bill, "I'll tell you. The whole thing was pitched into my lap by an old foundry friend now living the life of Reilly out in that favored land where the sun kissed waters of the Pacific roll in over the silver sands—"

"I know. They also roll out again and they are right wet. So is your story so far. Where does this Reilly fellow come in?"

"Sweet mother in heaven." The expression seemed to my sensitive ears to carry more venom than piety. "Sweet mother in heaven grant me patience. I don't know why I ever started this thing."

"That makes it unanimous," I said. "Carry on Jeeves. Tally-ho and all that jolly old stuff."



Pilgrim feels much safer on the outside

"Less of the tallyho stuff, if you please. Kindly swing her over on the port tack. Keep your eye on the boom, the binnacle and the luff of the foresail and keep your long furry ears open. There y'are. Hold her to her course and no more back chat, or by hoary old Neptune, his crown and trident I'll tell you no more."

"Aye, aye Sir. Steady as she goes."

"Ha! That's better. This friend of mine had a letter from a man in the House of Correction—pokie to you The idea back of these institutions is based on the belief that offenders against the law simply are naughty grown up children and that a salutary course in the gentle environment of the institution will return them to society purged and purified.

"I am not going to use actual names y'understand. You don't know any of the parties involved and so one name is as good as another. As they say in the movies if any name used here touches you on the raw, it is purely coincidental and kindly forget it, pliz.

"My first intimation of underworld activities came with a brief note from the gent basking on the silver sands and all that kind of stuff. 'Dear Bill' says this experienced basker, 'Enclosed you will find a letter recently received from the old home town. I do not seem to have any recollection of Daniel Hugh Juniper. It may be that he worked for me at one time more than 30 years ago when I ran a small foundry down near the railroad track. You will note on the envelope that the letter is directed to me at this address. You might

(*Continued on page* 47)

ADVERTISING PAGES REMOVED

(*Continued from page* 44)

start a few inquiries and let me know how you make out.'

"The enclosed letter scrawled with a pencil on the center of a sheet of House of Correction paper was brief and to the point. No shilly shallying. No beating about the bush. A hearty man to man greeting with all the usual frills and fripperies eliminated:

Dear Jim Carabine I am doing 1 year for intoxication see what you can do for me.

Daniel Hugh Juniper

"Wait a minute," I interrupted. "My credulity can be strained just so far. They don't put a man away in the Bastille for a year for intoxication. Can't you change the charge to grand larceny, malfeasance in office, bribery, robbery with intent to do grievous bodily harm. embezzlement or tragedy in a love nest?"

"You are not keeping up with the times and you are not living in one of these benighted countries where the crimes you have enumerated are taken seriously and where the judges are not elected by popular vote. In this free and enlightened glorious e pluribus unum republic the defendant in a love nest tragedy is given a vote of confidence by the jury and a contract in the movies. A man charged with malfeasance in office is removed temporarily and a month later is given a better job. Intoxication is in a different category. The commonwealth derives a handsome revenue from the sale of liquor, but it frowns sternly on the efforts of any individual to lap up the entire supply at one sitting. If he is nipped three times in succession by the johndarms and convicted three times by the beak, he is regarded as a menace to the peace and dignity of any fair city. If and when he appears before His Honor for the fourth time, the judge has no option but to retire him from circulation. He is sent to the House of Correction for a year."

"How do you happen to be so well informed on this subject?"

"I had all this inside dope confidentially from no less a person than Bro. Juniper, himself. I am not quoting his exact words, but with slight deletions here and there, the forgoing is a fair and free translation."

"You mean you actually saw and talked with this Juniper person?"

"Why not? You know me. Old Bill Brady, seventh son of a seventh son of Old King Brady of happy dime novel memory. Mysteries Solved While You Wait. When I start a job I like to finish it.

"Touching on the subject of Daniel Hugh Juniper—and Daniel Hugh is something of a touch artist himself—I wonder if you have

Modern version of Job and friend Bildad

read several short stories by an Irish author appearing intermittently in a prominent national magazine during the past few years. The stories delightfully and authentically Irish, center around the adventures and misadventures of one Thomasheen James, nicely referred to by the author as his man of no work. The reason I inquire is because the American Daniel Hugh Juniper and the Irish Thomasheen James have the same physical appearance, the same perennial thirst, the same sublime indifference to the trouble they cause friends and acquaintances, and apparently the same mental characteristics. Another feature they share in common is that a considerable part of their time is spent in jail.

"Since Daniel Hugh's brief, pithy and impassioned plea for assistance was written on House of Correction stationery I decided that this institution was the logical place to start my investigation. In reply to a telephone call I was informed that Mr. Juniper indeed was a guest there through the courtesy of Judge Bacardey. Reading from the guest record card my informant supplied the following personal and statistical data: Name, Daniel Hugh Juniper; no permanent address; age 42; height 5 feet 10 inches; weight 160 pounds; eyes blue; hair white and scanty; complexion fair; native born; occupation laborer; charge habitual intoxication; sentence 365 days commencing Dec. 17, 1938. Unfortunately the worthy official could supply no information on Mr. Juniper's early life and adventures.

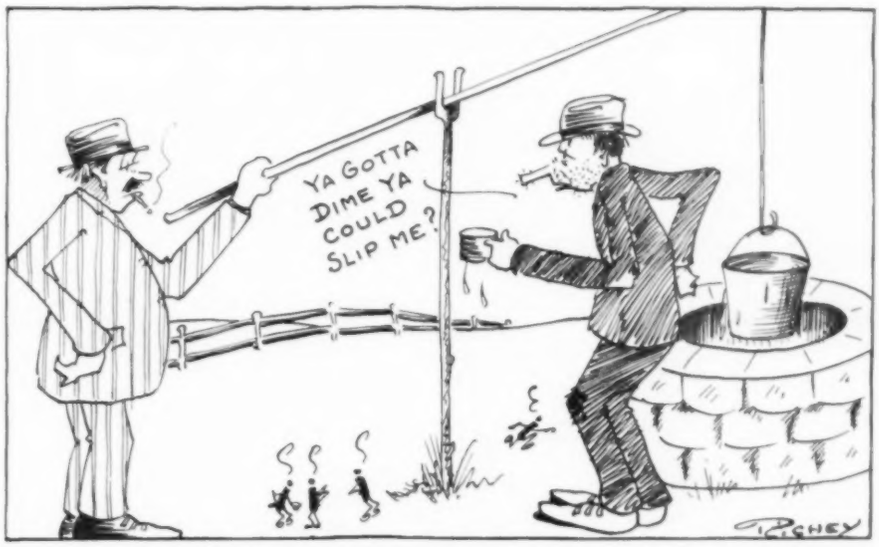
"'If you want any more information on the bird' the voice continued courteously 'why don't you take a gander down this way some time and have a talk with him?'

"Nothing could be fairer than that.

"A few days later I happened to be in the vicinity and I popped into the office of the famous farm. By a truly remarkable coincidence the first man I addressed was the same man with whom I had talked over the phone. I regarded this as a very fortunate omen since it relieved me of the necessity of telling my story over again, a detail I detest most cordially. He sent for Daniel Hugh, a tall, spare, shifty eyed gent with decayed teeth and a two or three day's growth of white bristles. He was bareheaded and arrayed becomingly in the regulation 2-piece uniform, blue overalls, tunic or jacket single breasted and closely buttoned up the front. The trousers needed a pressing, but since they met the principal requirement of extending from the belt to the shoe tops, further comment is not necessary.

"I need not detail the conversation. It is sufficient to report that my friend in the far West—Remember the silver sand fella?—need have no regrets of conscience if he

(*Concluded on page* 94)



Is it possible the misguided man wanted the dime to buy a chaser?

Cincinnati

A MOTION picture depicting the manufacture of chilled car wheels and an interesting discussion of a new method of controlling combustion in the cupola were presented by S. C. Massari, metallurgist, Association of Manufacturers of Chilled Car Wheels, Chicago, at the regular meeting of the recently organized Cincinnati District chapter of the A. F. A. held March 14 at the Hotel Gibson, Cincinnati. Following the dinner, George A. Seyler, Lunkenheimer Co., Cincinnati, a member of the board of directors of the A. F. A. and chairman of the organization committee of the chapter, introduced Herman K. Ewig, Cincinnati Milling Machine Co., and the newly elected chairman of the chapter. Mr. Ewig in turn introduced the officers and members of the board of directors.

Mr. Massari discussed the results of an extensive investigation which was undertaken to determine relationships between the following variables: Composition of the effluent cupola gases and their relation to the metal melted; composition of the effluent cupola gases and their relation to the loss of silicon and manganese; maximum efficiency of operation and the corresponding stage of combustion; and development of a reliable and yet simple automatic blast volume control for the regulation of combustion.

The automatic control for the blast volume, discussed by the speaker, involves the use of a differential pressure controller actuated by a pitot tube in the blast main which measures relative volume of blast entering the cupola. The differential pressure controller in turn is connected electrically by relays to a reversing motor of sufficient torque to open and close a spill gate on the cupola blower. In addition, an added refinement has been incorporated, namely carbon dioxide compensation. The carbon dioxide compensation mechanism is incorporated in a carbon dioxide recorder and is connected electrically to a small reversing compensating motor built on the differential pressure controller. The compensating motor changes the normal control point of the combustion pressure recorder to fit demands of the combustion within the cupola. In conclusion, Mr. Massari pointed to the economies in operation provided through this control.

The Cincinnati District chapter has elected the following officers: Herman K. Ewig, Cincinnati Milling Machine & Cincinnati Grinders, Inc., Cincinnati, chairman; H. F. McFarlin, Lunkenheimer Co., Cincinnati, vice chairman; E. T. Korten, Reliable Pattern & Castings Co., Cincinnati, secretary; Robert Frankel, Superior Pattern Works, Cincinnati, treasurer. The following with the officers constitute the board of directors: Earl H. Thompson, H. P. Deuscher Co., Hamilton, O.; E. F. Loges, Kramer Bros. Foundry Co., Dayton, O.; Chester A. Peebles, Stedman's Foundry & Machine Works, Aurora, Ind.; William M. Ball Jr., Edna Brass Mfg. Co., Cincinnati; Ray J. Redmond, Buckeye Foundry Co., Cincinnati.

Reading

CONTROL of properties in production of small, medium and large gray iron castings was the subject of the February meeting of the Reading Foundrymen's association, held at the Wyomissing club, Reading, Pa., Feb. 21. John N. Ludwig Jr., Electro-Metallurgical Co., New York, was the speaker.

Mr. Ludwig pointed out the effects of common elements such as carbon, silicon, manganese, phosphorus and sulphur, their relationship to the type of work produced and the most economical and satisfactory manner of their control. Variations in properties obtained through different means of adding these elements were covered, and the value of late cupola and ladle additions provoked an interesting and prolonged general discussion. Fifty-two foundrymen from the district attended the meeting.—*H. C. Cummings, secretary.*

Conn. Nonferrous

THIRTY members of the Connecticut Nonferrous Foundrymen's association attended its regular meeting held Feb. 21 at Hotel Duncan, New Haven, Conn. President Howard A. Phelps presided and before introducing the speaker, announced the appointment of the entertainment committee for 1939 which includes: Chairman, Fred B. Clarke, Whitehead Bros. Co.; vice chairman, Louis G. Tarantino, Niagara Falls Smelting & Refining Corp.; T. Joseph Judge, Jenkins Bros. Co.; H. Z. Dingee, Springfield Facing Co.; F. B. Diana, Whipple & Choates Co.; S. W. Chappell jr., Electric Boat Co.; and W. J. Kenney, North & Judd Mfg. Co.

Principal speaker at the meeting was George MacAdoo, Tuttle & Bailey Co., New Britain, Conn., who discussed ornamental cast grilles and bronze convection heater castings. The speaker exhibited a number of castings which were made of brass, bronze, aluminum and 15 per cent nickel silver. Sizes of the castings range from 2 x 4 inches to 5 x 6 feet. Composition of the brass employed was 70 per cent copper, 1 per cent tin, 2 per cent lead, and 27 per cent zinc. The bronze contained 81 per cent copper, 5 per cent tin, 2½ per cent lead, and 11½ per cent zinc. The aluminum was made from 50 per cent of a 99 per cent plus aluminum, and 50 per cent of an alloy containing 97 per cent aluminum with 1½ per cent manganese. To that mixture 5 per cent silicon in the form of 50-50 silicon-aluminum was added.

Sand used for the castings is made up of 1/3 French sand, 1/3 No. 00 Albany or Windsor Lock and 1/3 No. 1 Albany. That is the facing sand and it is placed at approximately ¼-inch thick on the pattern face. Large molds are skin dried

(*Continued on page* 50)

ANNOUNCING

DIXIE BOND

The strongest clay bond of any type ever offered to the foundry industry

Dixie Bond is a truly revolutionary, new product of importance to foundrymen for many reasons .... but most outstanding because, at last, here is a clay bond which develops tremendous green strength combined with another most desirable quality .... moderate dry strength.

What Dixie Bond IS:

Produced in the South, Dixie Bond is a non-swelling montmorillonite clay with unusual qualities which have never been available to foundrymen in any other clay bond.

What Dixie Bond DOES:

It develops tremendous green strength, in some mixes 40% higher than bentonite, and at the same time has a moderate dry strength, the advantages of which foundrymen will be quick to appreciate.

Dixie Bond, being a low dry strength bond, eliminates troubles encountered with high dry strength bonds such as:

1. Difficult and costly shakeout
2. Excessive abuse of flasks
3. Excessive loss of sand in screening out hard lumps
4. Cracked castings, particularly in malleable shops
5. Difficulty in re-tempering and re-mixing

Dixie Bond provides soft sand at the shake out which is easily re-tempered, and entire freedom from danger of cracked castings.

High permeability, high flowability, high sintering point and low contraction at high mold temperatures are other advantages of Dixie Bond.

THAT, briefly, is the story of Dixie Bond .... answering, we feel, the long-felt need of the foundry industry for a strong bond free from many of the disadvantages of previously available materials.

The use of Dixie Bond is covered by U. S. Patent 2,128,404 and each buyer is licensed in its use without added royalty charges. Each buyer also receives a Patent Protection Contract which protects against infringement of other patents, this contract being backed by Surety Bond.

We invite foundrymen to write us at once for more complete details and factual data on Dixie Bond. Samples will also be provided at your request.

EASTERN CLAY PRODUCTS, INC.

EIFORT, OHIO

DETROIT, MICHIGAN—1414 United Artists Bldg.

228 Highgate Avenue—BUFFALO, N. Y.

and a light molasses water solution containing 1 part of molasses to 15 parts of water is sprayed on. The speaker then described methods of gating the various types of castings and presented information on pouring temperatures.—*Louis G. Tarantino, secretary.*

Buffalo

REGULAR monthly meeting of the Buffalo chapter of the A. F. A. was held at Hotel Touraine, Buffalo, Monday, March 13. M. W. Pohlman, Pohlman Foundry Co., Buffalo, and chairman of the chapter presided with approximately 85 members and guests present to hear C. W. Briggs, Steel Founders' Society of America, Cleveland, discuss "Solidification, Shrinkage and Contraction of Metals." Mr. Briggs has had wide experience on this important subject and has specialized in research in metals. His familiarity with the subject enabled him to impart the knowledge in language familiar to foundrymen. His talk was so interesting that the members would like a return visit in the near future.—*J. R. Wark, secretary.*

Northeastern Ohio

OVER 120 members and guests attended the regular meeting of the Northeastern Ohio chapter of the A. F. A. held March 9 at Guildhall, Cleveland. Two coffee talks and the principal address of the evening were presented by members of the group. In the first coffee talk, J. S. Parker, Motor Patterns Inc., Cleveland, discussed various problems connected with patterns. He pointed out the vast difference between patterns 30 years ago and today and stated that since pattern lumber only amounts to 10 per cent of the total cost it never pays to use cheap lumber. In his opinion a skilled pattern maker always endeavors to make a pattern which can be molded easily and which will retain its shape indefinitely. Mr. Parker concluded by citing examples where modern pattern equipment increased production and lowered costs of producing castings.

J. A. Balazs, Hines Flask Co., Cleveland, spoke briefly on flask equipment for the foundry. He stated the use of wood flasks is a handicap to the foundry, due to the tendency to absorb water, spring out of shape and burn. In his opinion aluminum flasks eliminate these factors and enable the molder to do a better job. Mr. Balazs believed about 80 per cent of all light and medium castings can be made in slip flasks. In closing his talk he mentioned several examples where proper flask equipment cut losses and increased production.

The final feature of the meeting was an extremely interesting two-reel sound motion picture on production of aluminum and some of its applications, presented by H. J. Rowe, Aluminum Co. of America, Cleveland. Mr. Rowe stated that while considerable aluminum was being produced and used it amounts only to slightly over 1 per cent of the total of all metals. According to available figures 94 per cent of metals produced is iron and its various forms and the remaining 6 per cent includes copper, zinc, lead, aluminum, etc. Of the latter, aluminum production is about 18 per cent. Mr. Rowe also pointed out that 33 per cent of aluminum used is employed in the transportation field such as aircraft, railroads, etc.; 16 per cent is used for cooking utensils; 12 per cent for electrical conductors; 11 per cent for machinery and electrical appliances; 6 per cent in building applications, and 6 per cent in the chemical industry.—*Edwin Bremer.*

Central New York

SEVENTY-FIVE members and guests attended the regular meeting of the Central New York chapter of the A. F. A. held at the Onondaga hotel, Syracuse, N. Y. on March 10. H. H. Judson, chapter chairman, presided, and announced the appointment of two new committees. The program committee is comprised of Frank C. Wheeler, Kimman & Wheeler, Syracuse, N. Y., chairman; M. T. Ganzauge, Goulds Pump Inc., Seneca Falls, N. Y.; Prof. A. C. Davis, Cornell university, Ithaca, N. Y.; N. H. Boardman, Elmira Foundry, Elmira, N. Y.; G. F. Fay, Fay Foundry, Syracuse, N. Y.; H. H. Comstock, Syracuse Chilled Plow Co., Syracuse, N. Y., and Merrill Hollenbeck, Kennedy Valve Mfg. Co., Elmira, N. Y. Membership and reception committee is composed of B. Rathbun, Chemung Foundry Corp., Elmira, N. Y. chairman; F. F. Shortsleeve, Elmira, N. Y.; W. G. Jones, International Heater Co., Utica, N. Y.; W. H. Thomas, Straight Line Engine Co., Syracuse, N. Y., and J. A. Sperry, Sperry Foundry Corp., Oneida, N. Y.

Following the business meeting John N. Ludwig Jr., Electro Metallurgical Co., gave an interesting talk on "Use of Briquets in the Cupola." He stated that use of briquets for addition of silicon, manganese, and chromium in cast-iron melting is an important development in foundry practice, and described their applications and effects. In discussing additions of graphite to the ladle, Mr. Ludwig explained that it reduces the depth of chill and softens iron in light sections. It also refines graphite in both light and heavy sections. The speaker then took up the subject of ladle additions of ferromanganese, ferrosilicon, and ferrochromium, describing the effects of those materials, and the procedure for additions. Following Mr. Ludwig's talk, a lively discussion ensued.

At the close of the meeting Mr. Judson announced that Robert Watson, Hanna Furnace Corp., would speak on "Coke and Modern Cupola Practice" at the next meeting which will be held on April 14.—*Lloyd D. Wright, secretary.*

Southern California

JOINT meeting with the Los Angeles chapter of the American Society of Metals featured the Feb. 16 meeting of the Southern California chapter of A. F. A., held at the Los Angeles Athletic club, Los Angeles. J. G. Coffman, Los Angeles Steel Castings Co., and chairman of the A. F. A. chapter and George C. Stetter, Bethlehem Steel Co., and chairman of the A. S. M. chapter presided jointly.

Approximately 194 attended to hear E. C. Carlson, Aluminum Co. of America present a program on aluminum, which included the showing of "Aluminum: Mine to Metal," a motion picture describing the mining of bauxite, the manufacture of alumina and production of aluminum. Another picture, "Aluminm Fabricating Processes" depicted in detail the processes by which the metal is rolled drawn, extruded, cast and forged.

A. J. Troja, superintendent, Los Angeles division of Griffin Wheel Co., addressed the meeting prior to the showing the motion picture "The Story of the Chilled Car Wheel." This picture produced by the Association of Manufacturers of Chilled Car Wheels described the manufacture and metallurgy of chilled car wheels.—*M. S. Robb, secretary.*

New England

AT ONE of the best attended meetings of the New England Foundrymen's association this season, Marshall Post, vice president Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and president of the A. F. A., addressed the organization March 8 on the "Randupson Process."

Mr. Post described the process as a method of making molds with cement bonded sand, which process was patented in 1933. He stated that the cement bonding of sands was used somewhat extensively in England and on the continent. The talk was illustrated with interesting pictures showing typical castings made by the Birdsboro foundry. Many interesting questions were asked Mr. Post after the talk and his comments were very instructive.

(*Continued on page* 52)

Ohio Ferro-Alloys Corporation

Canton, Ohio

(*Continued from page* 50)

R. F. Harrington, Hunt-Spiller Mfg. Corp. announced that plans for the third New England regional conference now are completed. The conference will be held at Massachusetts Institute of Technology, Cambridge, Mass., Friday and Saturday, April 14 and 15.—*M. A. Hosmer.*

Chicago

AN UNUSUALLY large attendance featured the "Equipment Night", meeting of the Chicago chapter of A.F.A. at the Medinah club, Chicago, on March 13. James Thomson, Continental Roll & Steel Foundry Co., was chairman of the program designed to present improvements and most recent developments in modern foundry equipment. Participating firms were selected by lot to give 5-minute discussions, using models or pictures as desired. Questions were restricted to an informal discussion following official adjournment.

Participants under the subject of molding machines were: W. W. Hughes, Chicago representative, Herman Pneumatic Machine Co., Pittsburgh; Russel F. Lincoln, sales manager, Osborn Mfg. Co., Cleveland; L. D. Pridmore, vice president, International Molding Machine Co., Chicago. In the sand division the program presented: A. J. Rapp, Chicago representative, Clearfield Foundry & Machine Co., Clearfield, Pa.; R. C. Johnson, sales manager, Simplicity Engineering Co., Durant, Mich.; W. L. Hartley, engineer, Link-Belt Co., Chicago, H. L. McKinnon, vice president C. O. Bartlett & Snow Co., Cleveland; Lester B. Knight Jr., National Engineering Co., Chicago; C. D. Hollins, Chicago representative, Royer Foundry & Machine Co., Kingston, Pa.

Companies and subjects presented in the melting division were: Harvey Payne, Chicago representative, Pittsburgh Lectromelt Furnace Co., Pittsburgh; Harry W. Dietert, president, Harry W. Dietert Co., Detroit; Robert S. Hammond, vice president, Whiting Corp., Harvey, Ill.; A. E. Rhoads, manager, Detroit Electric Furnace division, Kuhlman Electric Furnace Co., Bay City, Mich.

In the cleaning division were presented: Fred A. Ebeling, sales manager, W. W. Sly Mfg. Co., Cleveland; E. B. Rich, Chicago representative, American Foundry Equipment Co., Mishawaka, Ind.; A. L. Gardner, advertising manager, Pangborn Corp., Hagerstown, Md.; Ronald Webster, vice president, Hydro-Blast Corp., Chicago; A. B. Eastwood, sales representative, Tabor Mfg. Co., Philadelphia; W. G. Frank, sales manager, American Air Filter Co., Louisville.

Russel J. Greenly, chairman, department of trades and industries, Purdue university, West Lafayette, Ind., will speak on "Human Engineering" at the April 10 meeting of the Chicago chapter. — *J. F. Powell.*

Detroit

SIXTY-FIVE were on hand for dinner at the March 16 meeting of the Detroit chapter at the Fort Shelby hotel. Well over 80 were in attendance by the time the technical session was started. Preceding the address of the evening, a reel of travel moving pictures was shown by R. B. Crawford, Atlas Foundry Co., being the record for a recent southern trip he had made.

Demonstration of molding and pouring at Chicago chapter lecture course

Don J. Reese, development engineer, International Nickel Co., New York, spoke at length on cupola charging and control methods, discussing proper methods of charging and control of blast pressure to effect the most efficient operation of the cupola. He presented some new ideas on the control of blast pressure to produce high-temperature iron.

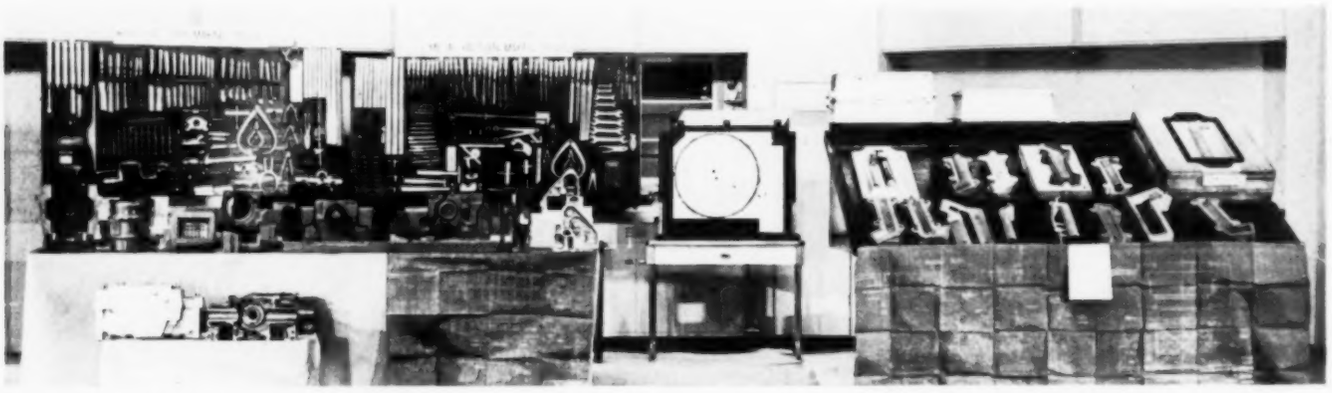
Annual foundry conference sponsored by the Detroit chapter and Michigan State college at East Lansing is expected to draw many of the local members when it convenes April 14 and 15. The meeting this year will be a "castability conference," with the general subject matter divided into two classifications—external influences and internal reactions.—*A. H. Allen*

New York-New Jersey

AN ILLUSTRATED talk on the Randupson process was delivered by H. F. Scatchard, industrial engineer, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., before members of the Metropolitan N. Y.-N. J. chapter of the American Foundrymen's association at the Essex House, Newark, N. J., March 6. Between 45 and 50 were present.

A cement bonded sand process developed originally in France, the Randupson procedure had been used with excellent success by the Birdsboro company, according to the speaker. Due to freedom from mold warpage and distortion because artificial drying is not necessary, high dimensional accuracy can be obtained. On steel castings virtually no nailing is necessary and on iron castings only the larger jobs require nailing and then only in a limited

(*Continued on page* 55)



Interesting and instructive display of pattern making materials and problems, as arranged by J. E. Kolb, pattern supervisor, Caterpillar Tractor Co., Peoria, for the Chicago chapter lecture course

ADVERTISING PAGES REMOVED

(*Continued from page* 52)

degree, such as might be necessary for corners or fillets. Speaking of dimensional accuracy, Mr. Scatchard said that they could obtain tooth tolerances of one thirty-second of an inch.

Molds for this process can be made from any pattern designed for dry sand molding, by the core box method or by the sectional method, if symmetrical. The process, which has been in operation at the Birdsboro plant about four years, has resulted in great savings in cleaning room cost. This saving in cleaning room time more than offsets the longer time required in molding. The speaker cited various instances where they had been able to successfully compete for a job because of the time they were able to save under the process. Use of silica sand, the higher the silica the better, was desirable in the mixture.—*B. K. Price.*

Philadelphia

REGULAR meeting of the Metropolitan Philadelphia chapter of the A.F.A. was held March 10 at the Engineers club, Philadelphia. Approximately 135 members attended, with Harold Henszey, Carborundum Co., Philadelphia and chairman of the chapter presiding. The after dinner speaker, H. R. Salisbury, Air Reduction Sales Co., Philadelphia, spoke on "Liquid Air", and was introduced by Lee Harris. John H. Spencer, technical chairman of the evening introduced H. W. Kelly, foundry engineer, Meehanite Metal Co., Chicago, whose topic was "Modern Developments in Cast Iron".

Mr. Kelly's discussion was in two parts, the first dealing with 12 methods of charging cupolas illustrated with lantern slides and graphs showing the man hours and costs of charging 10 to 50 tons in a 48-inch cupola. Part two of this talk dealt with the new improvements in cleaning equipment and also was illustrated with slides and plant layout drawings.

Next regular meeting will be Monday, April 17 which will be a joint meeting with the American Welding society. The speaker is Charles W. Briggs, Steel Founders Society of America, Cleveland, and his subject, "Welding of Forgings". There will be a special meeting on Friday, April 21, National President's night in honor of the chapter's own member, Marshall Post, vice president, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and president of the A.F.A. Dr. M. M. Dorizas will discuss, "My Views on the Germany-Czechoslovakia Situation".—*J. T. Fegley, chairman, publicity committee.*

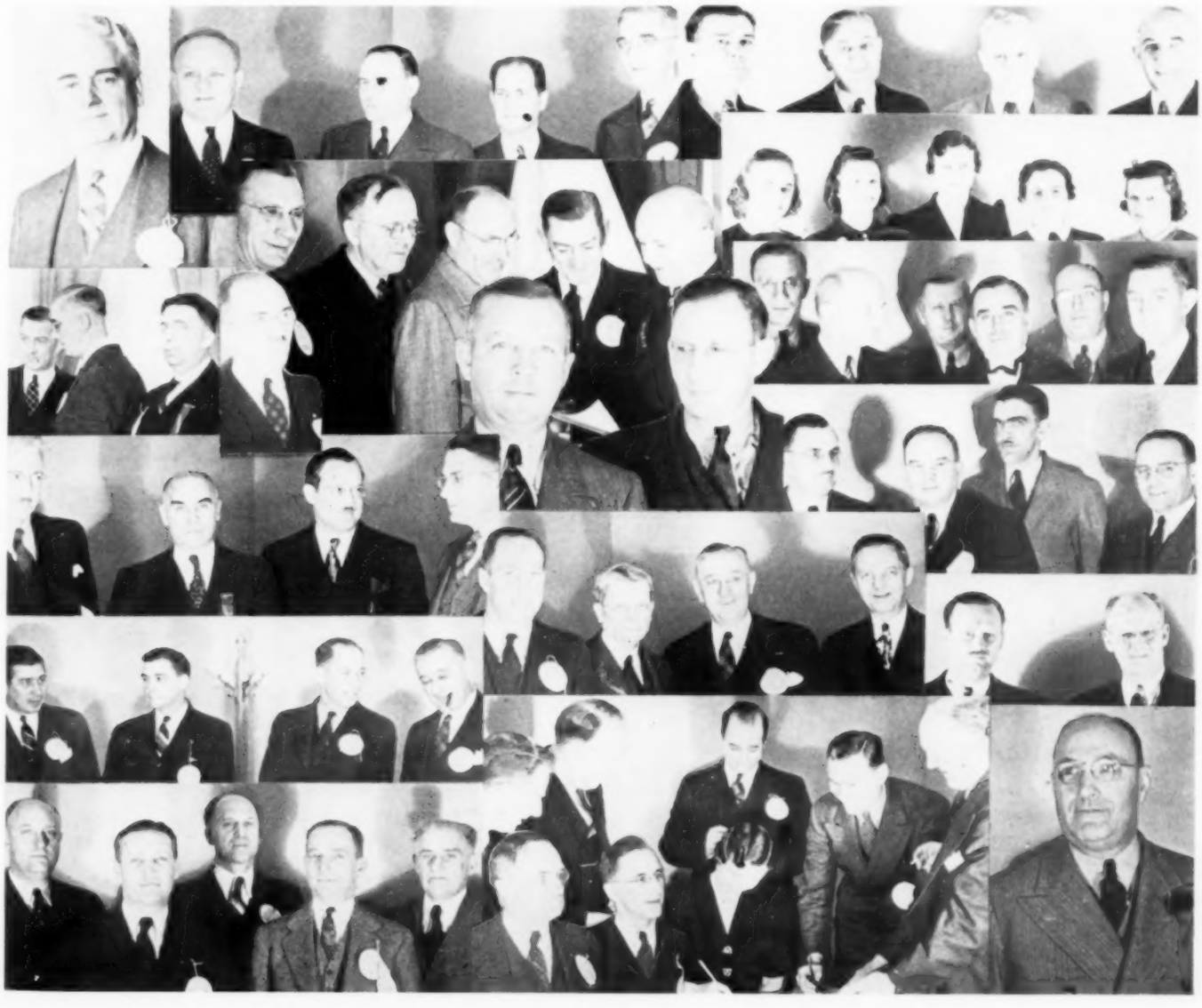
St. Louis

THIRD meeting of the year of the St. Louis District Chapter of the A.F.A. was held March 9 at the York Hotel, St. Louis. Vice-chairman L. E. Everett presided and introduced two new members of the chapter, namely, E. M. Carlson and Lee H. Horneyer, Cleveland Pneumatic Tool Co. Mr. Everett directed special attention to the forthcoming fall regional conference of the chapter, which is to be held Oct. 5, 6 and 7 at the Jefferson Hotel, St. Louis. Louis Desparois, chairman of the conference committee, outlined in some detail plans for the elaborate meeting.

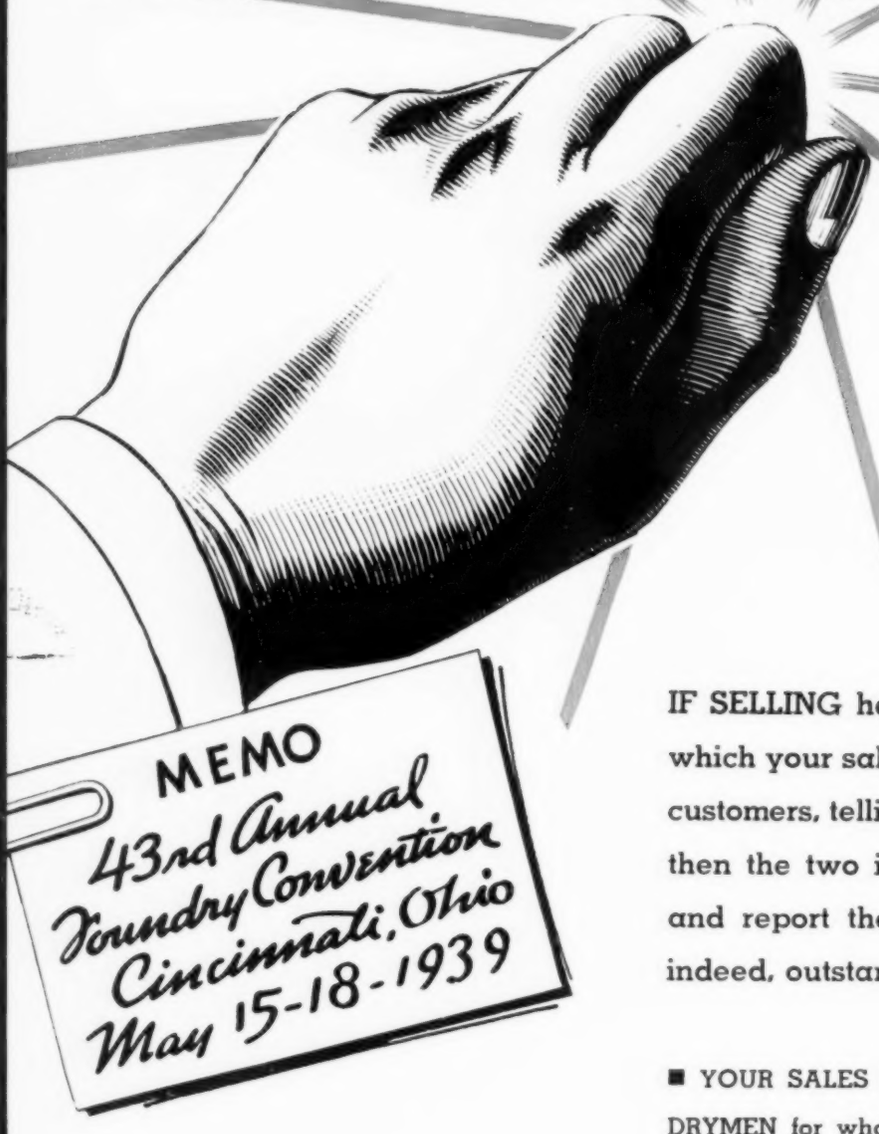
Program committee chair-

(*Concluded on page* 58)

Candid shots taken at recent Wisconsin Regional conference by John Bing, dist. sales manager, A. P. Green Fire Brick Co., Milwaukee



OPPORTUNITY



IF SELLING has to do with the aggregate time during which your salesmen are in the presence of prospective customers, telling your sales story to interested listeners, then the two issues of THE FOUNDRY which preview and report the forthcoming Foundry Convention are, indeed, outstanding sales opportunities!

■ YOUR SALES MESSAGE IN THESE ISSUES REACHES FOUNDRYMEN for whom their annual convention is the rallying point for the discussion of foundry management and production problems, in the final solution of which you have an important stake. Foundrymen who attend the convention and those who do not . . . all will read these issues carefully for their timely, extra editorial features.

■ YOUR ADVERTISING IN THE MAY AND JUNE ISSUES CAN BE A POSITIVE FACTOR in aiding foundrymen to run their businesses more profitably, execute their jobs more effectively. What you say in these issues will have the benefit of an interested reader-audience . . . your advertising will receive the sort of thoughtful consideration you are looking for.

KNOCKS TWICE

MAY PRE-CONVENTION ISSUE

This issue is read with keen interest because it previews the Foundry Convention in its entirety . . . the schedule of sessions, giving the time, place, speakers and subjects . . . outline of social functions . . . plant visitation program . . . Cincinnati as a foundry center . . . places to go . . . things to do . . . focusing the interest, holding the attention of readers the world over. These, in addition to the regular features of any issue of THE FOUNDRY, make the May issue an advertising opportunity with merit.

JUNE POST-CONVENTION ISSUE

Foundrymen will turn to the Post-Convention issue for the story of what happened . . . what was said . . . who was there. To the "stay-at-homes", this issue will be the convention itself, and to those who attended the Cincinnati meetings . . . a welcomed report and review of all that transpired. Foundrymen everywhere will pay close attention to the profit-making ideas which crystallize at the 1939 Convention . . . the story of which they will read in this issue. The JUNE issue . . . an advertising opportunity!

THE FOUNDRY

ADVERTISING DEPARTMENT

CLEVELAND

(*Concluded from page* 55)

man Webb L. Kammerer announced that plans have been completed for the extension meeting to be held at the President hotel, Kansas City, Mo. on April 21. That meeting is a part of the St. Louis chapter efforts to increase interest and membership in the A.F.A. Principal speaker at that meeting will be C. R. Culling, Carondelet Foundry Co., St. Louis, who will talk on "General Foundry Practice in a Specialty Jobbing Foundry."

Bruce E. Braun, vice-president in charge of operations for Chicago Southern Airlines Inc. then was introduced and spoke on "Rails of the Air". This talk outlined in an original and interesting manner methods of operation and rules for various airlines, giving emphasis to the part played by radio. Following Mr. Braun's talk, the Crane Co. motion picture, "Flow," was shown. The film showed numerous foundry and other operations of the Crane Co., and considerable interest was manifested by the entire chapter in that well-presented movie. — *J. W. Kelin, secretary.*

Pittsburgh

DEFECTS in nonferrous castings and probable causes of these were outlined by Sam Tour, Lucius Pitkin Inc., New York, for the February meeting of the Pittsburgh Foundrymen's association.

Approximately 75 members and guests of the association were present at the Fort Pitt hotel to hear Mr. Tour's discussion. Outlining 22 different types of defects in nonferrous castings, the speaker showed how these were caused by 10 factors. Anywhere from one to seven of these factors may contribute to one particular defect. These factors include design, pattern equipment, mold setting, gating, molding, molding sand, cores, metals, melting and pouring.

Following the talk by Mr. Tour, movies of safety tires were shown by Goodyear Tire & Rubber Co. representatives.

Regular March meeting of the Pittsburgh Foundrymen's association was held Monday, March 20, in the English room of the Fort Pitt hotel. Approximately 125 members and guests heard Donald J. Reese, metallurgical engineer, development and research division, International Nickel Co., New York, discuss production and properties of high strength cast iron.

Mr. Reese, has visited 1500 foundries here and abroad during his work. His talk was based on defining the various strength levels attainable, methods of melting including cupolas, air furnaces, electric furnaces, and others. Effects of various factors on the properties of iron also were discussed. In the latter group were included melting mediums, pouring temperatures, speed of pouring and other factors. The discussion was illustrated with lantern slides showing structures of various types of cast iron as well as some of the applications of high strength iron. Active discussion on the paper was led by C. M. Arnold, director of research, Blaw-Knox Corp., Groveton, Pa.

Motion pictures showing quarrying and further processing of stone for lining cupolas, converters, ladles and other refractory applications were exhibited by E. A. Burr, vice-president, Cleveland Quarries Co. Cleveland, and a member of the Pittsburgh Foundrymen's association.—*R. L. Hartford.*

Quad City

JOINT meeting of the Quad-City chapter of the A.F.A. and Tri-City chapter, A. S. M. was held Monday evening, Feb. 20 at Fort Armstrong hotel, Rock Island, Ill. Approximately 125 were present for the meeting. Harold Markuson, chairman of the American Society for Metals chapter called the meeting to order and turned it over to M. J. Gregory, chairman of the American Foundrymen's chapter to introduce the speakers.

O. R. Reller, chairman, Tri-City chapter of the American Society of Tool Engineers, was introduced to the group and spoke of the recent organization of a chapter in the area and the possible relation of that society to other metal groups.

Chief speaker, F. F. Vaughn, assistant chief metallurgist, Caterpillar Tractor Co., Peoria, Ill., discussed "Metallurgical Quality Control of Forgings, Castings and Heat Treatments." A complete plan of work with regard to quality control was given. Points of importance given consideration are: Investigations, testing and processing. Mr. Vaughn gave many examples of various points and used a number of slides to give a concise and accurate picture of the work of making castings, forgings and machine parts. Many questions were asked the speaker and much interest was evidenced by the group.

The chapter held a regular meeting on March 20 at the Blackhawk hotel, Davenport, Iowa, with 100 present. Horace Deane, Deere & Co., Moline, Ill., vice chairman of the chapter, presided. The nominating committee was appointed as follows: S. W. Kirby, chairman; Gust Vergane, E. C. Wussow, and A. E. Hageboeck.

W. A. Stephenson presented a coffee talk on "Commercial Aviation" to which he discussed the history, advancement and future possibilities of the flying industry.

C. R. Culling, vice president, Carondelet Foundry Co., St. Louis, presented the principal talk of the evening on "General Foundry Practice in a Specialty Jobbing Foundry." In a foundry of that type with all of the variations, it is important to have an organization that can diagnose any situation which may arise in the various departments. The equipment should be adequate to meet the need of the production demand and a chemical and physical laboratory is desirable. Mr. Culling pointed out some of the problems which have been solved by his organization in developing the proper foundry practice to meet the particular needs of the plant. This discussion was concluded with an interesting series of slides giving concrete examples of many of the practices followed. Many important questions were introduced by members of the chapter in the discussion which followed.

The next meeting of the chapter will be held at the LeClaire hotel, Moline, Ill. on April 17.—*J. Morgan Johnson.*

Book Review

Welding Handbook, 1938 *Edition*, imitation leather, 1200 pages, 8¾ x 6 inches, published by American Welding society New York, and supplied by THE FOUNDRY, Cleveland, for $6 and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This first edition of a handbook assembled by the American Welding society will meet the demand of long standing for practical, authoritative information in concise form on the subject of welding. More than a year and a half was required in its preparation and it was kept up-to-date to the time of printing. Covering every phase of welding, it represents the efforts of 90 authors and 237 reviewers.

The volume covers, first, the fundamentals of the various processes; second, materials used and testing methods involved; and third, applications. This treatment of the broad subject of welding is supplemented by data on metal cutting and a number of processes allied to welding and cutting. Of particular interest to foundrymen is the critical digest of literature on the methods of welding malleable and gray cast iron, and cast steel.

American Society for Testing Materials recently has issued its annual index to A.S.T.M. standards and tentative standards including list of A.S.T.M. serial designations. Copies may be obtained by addressing the society's headquarters, 260 South Broad street, Philadelphia.

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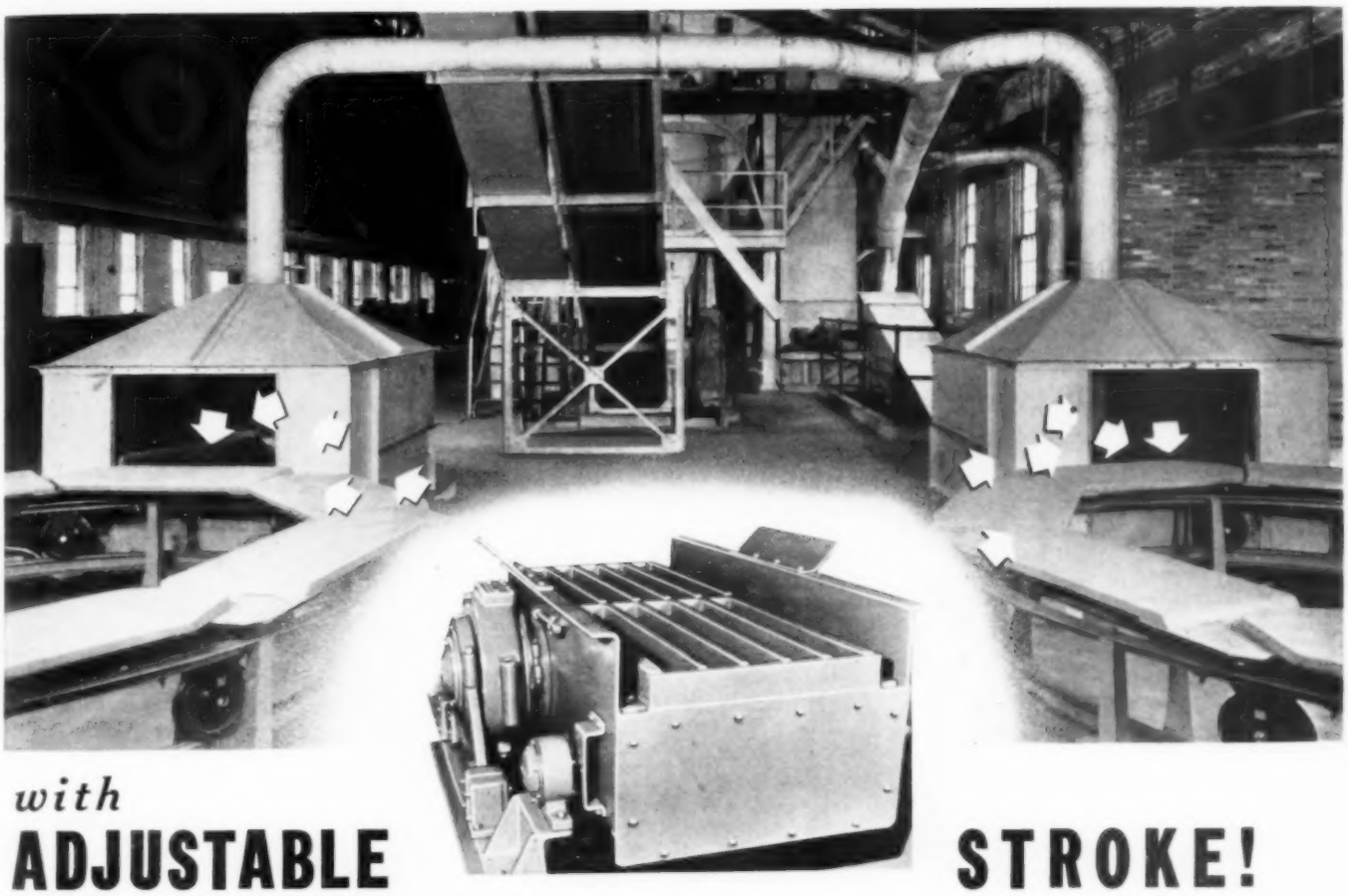

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Photo courtesy Aerofilms Ltd.

The Tower bridge and the City of London

London Beckons World Foundrymen

AN ENTHUSIASTIC welcome awaits American foundrymen and visitors from all the industrial countries of the world who will attend the Seventh International Foundry Congress to be held in London in June, and organized by the Institute of British Foundrymen.

The program is now completed. About 30 papers, covering all the principal aspects of foundry practice, will be presented in English during the technical sessions. The official American exchange paper will be by Fred A. Melmoth, Detroit Steel Casting Co., Detroit, the subject being: "Renaissance of Steel Castings and the Role of the Metallurgist." The fourth Edward Williams lecture will be given by Prof. W. L. Bragg on "Atomic Pattern of Metals." The initial meeting in London will be held Tuesday, June 14, and will be opened by the Lord Mayor of London.

Considerable attention has been given to works visits, and delegates who take the post-congress tour as well as the London congress week will have an opportunity of visiting practically every type of foundry, ferrous or nonferrous, that can be seen in Great Britain, including large mass-production foundries. Even during the London week, a variety of foundries will be open for inspection in between the technical sessions, including general iron foundries, malleable foundries, a vitreous enameling shop, nonferrous foundries, one of which is an interesting bell foundry, and the foundry of the Ford Motor Co. at Dagenham.

The business part of the congress has been planned with a view to giving every visitor an opportunity of discussing and studying the particular aspect of the industry in which he is interested, and, thanks to the range of papers presented, the authority of the authors, and the importance and successful operation of the works to be visited, it is hoped that each one will return to his own country having materially increased his knowledge and experience.

While the attention of the organizing committee has been directed especially to the serious part of the program, considerable thought and ingenuity have been expended on the social side, and many interesting events pleasantly will intersperse the technical sessions and works visits.

On the Sunday afternoon, June 11, immediately preceding the opening of the congress, Barrington Hooper, managing director of Industrial Newspapers, Ltd., who then will be president of the London branch of the I.B.F., and Mrs. Hooper have extended an invitation to those visitors who will have arrived from overseas to attend a garden party at their home. This will afford a delightful opportunity for renewing old friendships and starting new contacts.

The committee of patronage includes the name of the president of the board of trade, and a government reception will be given, on Tuesday evening, June 13, at Lancaster house, which is not only a stately building for government receptions, but also one of London's interesting museums housing a collection of objects associated with the history of London.

The banquet, on Wednesday, June 14, will, it is hoped, be attended by all members of the congress, and President W. B. Lake and Mrs. Lake, supported by Dr. Guido Vanzetti, president of the International committee of foundry technical associations, and Signora Vanzetti, are looking forward to receiving the guests. The guest of honor will be the president of the board of trade, who will give the toast to the industry and the institute.

On the Thursday evening there will be a reception given to all members of the congress by President and Mrs. Lake, and this will be the occasion for a novel form of entertainment that will include many pleasant and unexpected features. On Saturday, June 17, an all-day excursion has been organized, to take visitors to Windsor castle, one of the royal residences, and this will be followed by a steamer trip on a delightful stretch of the River Thames, which is probably at its best in the early summer.

A full program of entertainment has been arranged for the lady visitors, among the main features being: Tea on the terrace

(*Concluded on page* 62)

. . . THE SUCCESS

of any foundry depends upon the coordinated efficiency of all departments. Hermans will keep costs in your molding department down, boost your production and give you molds of superior quality that will result in better castings and fewer rejects. Have our representative explain how. No obligation, of course. Herman Pneumatic Machine Company, Union Bank Building, Pittsburgh, Pa.

M O L D I N G M A C H I N E S

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(*Concluded from page* 60)

of the Houses of Parliament, overlooking the Thames; a visit to the Hall of the Worshipful Company of Barbers, one of the 78 livery companies of the City of London still in existence and, in fact, the only one to have escaped completely unscathed from the great fire of London in 1666. One all-day trip will include a visit to a hat factory in the morning, and in the afternoon, a visit to the unique Whipsnade Zoo, where animals can be seen free from prison walls. On Friday, June 16, organized tours will enable the ladies to obtain a comprehensive idea of London's main features of interest in the morning, and to enjoy a restful afternoon at Hampton court and Kew gardens.

For the post-congress tour, the local branches of the Institute of British Foundrymen have arranged a comprehensive and varied program, including works visits and other features, to entertain their visitors. This tour will enable the members of the congress to visit some of the most interesting and beautiful parts of England and Scotland, including the Shakespeare country, the Derbyshire vales, the Lake district, the Firth of Clyde, some outstanding Scottish scenery, and the historical and beautiful city of Edinburgh.

American foundrymen may receive further information on the program for the congress by addressing Frank G. Steinebach, chairman of the International Relations Committee of the A.F.A., Penton building, Cleveland.

Book Review

Alloys of Iron and Nickel, Vol. I, Special Purpose Alloys, by J. S. Marsh; cloth, 593 pages, 6 x 9 inches; published for the Engineering Foundation, by the McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $6, and in Europe by the Penton Publishing Co. Ltd., London.

This volume is the tenth of a series entitled, "Alloys of Iron Monographs" prepared under the auspices of the iron alloys committee of the Engineering Foundation. As its title indicates, this book is the first of two on alloys of iron and nickel, and is devoted to the constitution and properties of high purity, iron-nickel alloys and to the properties of special purpose alloys. The second book will be concerned with engineering properties of nickel steels and cast irons.

The present book is divided into 13 chapters of which the first serves as the introduction giving historical features. Chapter II discusses the iron-nickel system describing the high and low temperature portions of the diagram. The iron-carbon-nickel diagram is the subject of chapter III while the constitution of complex iron-nickel alloys is reviewed in chapter IV. Chapter V gives information on physical properties of iron-nickel alloys including elastic constants, lattice constants and densities, and thermal properties.

Chapter VI is concerned with thermal expansion, and the magnetic properties of iron-nickel alloys are fully detailed in chapter VII. Magnetic properties of complex nickel-iron alloys receive close examination in chapter VIII while the mechanomagnetic properties are discussed in chapter IX. Electric properties are described in chapter X, and chapters XI and XII are devoted to the mechanical properties of iron-nickel, and complex iron-nickel alloys respectively. The final chapter in the book is concerned with corrosion of iron-nickel, and iron-nickel-chromium alloys, and with scaling.

New England Will Hold Conference

Third Regional Foundry conference under the joint sponsorship of the New England Foundrymen's association, the American Foundrymen's association, and the Massachusetts Institute of Technology will be held at the institute, Cambridge, Mass., on April 14 and 15. Committee on conference arrangements consists of Chairman R. F. Harrington, Hunt-Spiller Mfg. Corp., South Boston, Mass.; Vice-chairman Charles O. Butler, Warren Pipe Co. of Mass., Everett, Mass.; LeRoy M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.; David L. Parker, General Electric Co., Lynn, Mass.; A. S. Wright, Hunt-Spiller Mfg. Corp., South Boston, Mass.; Prof. J. M. Lessells, and Prof. P. E. Kyle, Massachusetts Institute of Technology; R. G. Elphinstone, Westinghouse Electric & Mfg. Co., Springfield, Mass.; Louis G. Tarantino, Niagara Falls Smelting & Refining Corp., and secretary of the Connecticut Nonferrous Foundrymen's association, Bridgeport, Conn.; H. S. Washburn Jr., Plainville Casting Co., Plainville, Conn., and secretary of the Connecticut Foundrymen's association; and Robert J. Nelson, Arcade Malleable Iron Co., Inc., Worcester, Mass., and president of the N. E. F. A.

Registration and reception committee will be composed of Chairman R. H. Rehm, Whitehead Bros. Co., Providence, R. I.; Treasurer T. C. Wilson, Republic Steel Corp., Boston, and local representatives of the foundry supply firms in that region. Co-operating organizations include the American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Society for Metals, and American Welding Society.

Friday morning session of the meeting will be devoted to the important subject of personnel problems. First session of the afternoon program will cover spectroscopy as applied to foundry problems, and the second session will be devoted to developments in high test iron.

Saturday morning a round table discussion will deal with the subject of blended sands in foundry practice. First session of the afternoon will be on the subject of pressure bronze castings, while the final technical session pertaining to variables in the core room, will offer an excellent opportunity for discussion of a problem of interest to all foundrymen as well as designers and users of castings. The tentative program follows:

Friday, April 14

9:00 a.m.—Registration, Main lobby.

10:15 a.m.—Opening Remarks.
Chairman, Charles O. Butler, Warren Pipe Co. of Massachusettse Inc., Everett, Mass.
Welcome by Dr. Karl T. Compton, president, Massachusetts Institute of Technology, Cambridge, Mass.

10:30 a.m.—Luman S. Brown Session.
Chairman, E. H. Ballard, General Electric Co., Lynn, Mass.
Personal Problems of the Modern Industrialist, by J. E. Doyle, director, division of unemployment compensation, Commonwealth of Massachusetts.

12:30 p.m.—Luncheon, North hall, Walker Memorial.

2:00 p.m.—Technical Session.
Chairman, Dr. R. S. Williams, Massachusetts Institute of Technology.
Application of Spectroscopy to Foundry Problems, by Dr. G. R. Harrison, Massachusetts Institute of Technology.

3:00 p.m.—Technical Session.
Chairman, Walter M. Saunders Jr., Providence, R. I.
Recent Developments in High Test Cast Iron, by J. S. Vanick, International Nickel Co., New York.

6:00 p.m.—Conference dinner, North hall, Walker Memorial.
Presiding, R. F. Harrington.
Speakers, Henry S. Washburn, Plainville Casting Co., Plainville, Conn., and vice president of the A. F. A., and W. F. Piper, Beardsley & Piper Co., Chicago.

Saturday, April 15

10:00 a.m.—Roundtable Discussion.
Chairman, A. S. Wright, Hunt-Spiller Mfg. Co., South Boston, Mass.
Some Experiences with Blended Sands for Iron and Steel, Leader, D. L. Parker, General Electric Co., Lynn, Mass.

12:30 p.m.—Luncheon, North hall, Walker Memorial.
Coffee talk—Commercial Aviation, by W. N. Bump, American Airlines Inc.

2:00 p.m.—Technical Session.
Chairman, Justin A. Duncan, William Duncan Co., East Boston, Mass.
Production of Pressure Bronze Castings, by D. Frank O'Connor, Walworth Co., South Boston, Mass.

3:00 p.m.—Technical Session.
Chairman, LeRoy M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.
Variables in the Core Room, Their Treatment and Cure, by L. P. Robinson, Werner G. Smith Co., Cleveland.

5:00 p.m.—Adjournment.

Birmingham Sets New Record

BIRMINGHAM again broke all attendance records. With a total registration of 690, the seventh annual foundry practice conference held Feb. 23 and 24 at the Tutwiler hotel, Birmingham, not only exceeded previous attendance records for the Southern conference, but established an all time record for regional foundry conferences. This year the conference was arranged entirely by the Birmingham district chapter of the A. F. A.

Highlights of the two day meeting were six technical sessions, an extensive and well organized plant visitation program, a luncheon on Thursday and the annual banquet on Friday evening which was attended by 467.

The plant visitation program proved especially attractive to visitors at the 1939 conference. The following foundries were open for inspection: American Cast Iron Pipe Co.; A. B. C. Coal & Coke Co.; Anderson Brass Works Inc.; Birmingham Stove & Range Co.; Caldwell Foundry & Machine Co.; Continental Gin Co.; Dixie Bronze Co.; Miller Foundry Co.; McWane Cast Iron Pipe Co.; National Cast Iron Pipe Co.; Republic Steel Corp.; Sloss-Sheffield Steel & Iron Co.; Southern Wheel Co.; Stockham Pipe Fittings Co.; Thomas Foundries Inc.; Tennessee Coal, Iron & Railroad Co.; U. S. Pipe & Foundry Co.; Unit Stove & Furnace Co., and Woodward Iron Co.

The following supply houses were open on Saturday morning: Alabama Clay Products Co.; Foundry Service Co.; Hill & Griffith Co.; Long-Lewis Hardware Co.; McVoy Housman Co.; Moore-Handley Hardware Co.; W. J. Bullock Co.; Young & Vann Supply Co.; Wimberly & Thomas Hardware Co.

The various activities of the meeting were arranged by committees of the Birmingham chapter with the following chairmen: Program, W. E. Jones; Publicity, Tom Benners Jr.; Registration, Aubrey White; Entertainment, William Oberhelman, chairman and R. R. Deas, vice chairman; Plant visitation, Lynn L. Ogden; Membership, A. S. Holberg. The ladies entertainment committee consisted of Mrs. R. L. Ogden, chairman; Mrs. W. O. McMahon, Mrs. L. N. Shannon and Mrs. R. R. Deas Jr. C. B. Saunders is chairman of the Birmingham district chapter, R. C. Harrell, vice chairman, and W. O. McMahon, secretary-treasurer of the organization.

C. B. Saunders, Tennessee Coal, Iron & Railroad Co., Birmingham, and chairman of the District chapter, opened the first technical session Thursday morning with a welcome to the conference visitors. W. E. Curran, Republic Steel Co., Birmingham, was chairman of the session which was devoted to the discussion of a paper "Blast Furnace Production of Foundry Pig Irons," presented by C. S. Lawson, Sloss-Sheffield Steel & Iron Co.

Mr. Lawson discussed the early history of iron making in Alabama; the construction of the modern blast furnace and present day practice in foundry iron. He stated that production of foundry iron is much more exacting than basic iron, used for conversion into steel. To produce foundry iron that will be entirely satisfactory in making good, clean castings capable of meeting all requirements of soundness, strength, machineability, enameling, etc., extreme precautions must be taken at the blast furnace. Raw materials must have the proper analysis. The material must be of proper size to give even distribution of the voids when charged into the

furnace, also the blast volume must be correct.

In the discussion which followed, interesting points were developed on the effect of chilled pig iron upon the castings made with that iron. It was stated that while the foundryman's aversion to the use of chilled pig iron in the cupola may be based partly on superstition, investigations have disclosed that iron poured from such pig may have white sections in the casting. Relative merits of small and large pigs also was discussed. The suggestion was made that the diameter of the pig iron has more effect than the length, but that no difference will be found if the iron is melted hot.

Held Joint Meetings

Leroy P. Robinson, Werner G. Smith Co., Cleveland, and chairman of the Northeastern Ohio chapter of the A. F. A. was the guest speaker at the luncheon on Thursday noon, with Karl Landgrebe, Tennessee Coal, Iron & Railroad Co., presiding. L. N. Shannon, director of the A. F. A., and recently nominated for the office of vice president of the association, paid tribute to the contribution made by the Birmingham section of the A. S. M. E. in previous years in making the annual foundry conference a success. Prior conferences were organized jointly by engineers and foundrymen.

Relation of cast iron compositions to pin holes and blistering of porcelain enamels was discussed by D. B. Noland, Gray & Dudley Co., Nashville, Tenn., at the first afternoon session under the chairmanship of S. J. Price, Birmingham Stove & Range Co., Birmingham. According to the speaker, pin holes and blisters in cast iron enamels are alike since pin holes merely are the skeletons of scars of blisters that appeared early in the firing cycle of the enamel, blisters that burst and did not heal over. Broadly speaking all pin holes and blisters are caused by gases evolved from the iron or from the interface of the enamel and the iron. In some instances blisters and pin holes are caused by foreign inclusions in the enamel, from combustion and other gases in the firing chamber, but these instances were not discussed.

Citing instances of analyses taken over a 15 year period the speaker claimed that the manganese-sulphur ratio exercises an important influence on the behavior of iron going through the enameling process. Good enameling iron should show a ratio of approximatetly 7 points of manganese to 1 point sulphur. The carbon equivalent should be around 4.3. Whether a sound casting, free from dirt, slag, free carbon, oxidized iron, kish and sand holes will blister or not depends on the rate and degree of graphitization.

Conditions Produce Blisters

If the combined carbon is in form to break down at low temperatures or early in the firing cycle before the enamel has fused and there are no combustible gases in the furnace, there is small likelihood of blistering. At the opposite extreme, if the graphitization is very slow and does not occur until after the enamel has fused, blistering does not occur. If the combined carbon is in form to change to graphitic between these two extremes, or at the critical period when the enamel is fused and ready to be removed from the furnace, a profusion of blisters may be expected in various stages.

Other contributory factors include molding practice, sand condition, cupola charging, pig iron and slag. Moisture content of the sand is an extremely important factor. Where iron is poured against sand that is too wet, the combined carbon will not break down properly. Obviously light, thin sections give more trouble than thick sections in that respect.

The paper precipitated a lively discussion on the various features presented, particularly the composition of the iron, and the effect of pouring the metal into molds that produced a slight chilling effect on the surface. Replying to a question from the floor, the speaker agreed that design in many instances is an importatant factor in the enameling process. With black board sketches he illustrated types of design that invariably cause trouble.

Outlined Rate Classification

One of two simultaneous sessions on Thursday afternoon at 4 p. m. was devoted to a paper "Job Evaluation," by A. H. White, Stockham Pipe Fittings Co., Birmingham. W. J. Cotlin, American Cast Iron Pipe Co., Birmingham, presided.

Mr. White first discussed the origin of job evaluation and accurate classification of wages, and then traced the progress which has been made during the past 30 years. He then described the work of the Stockham company in providing a system of rate classification. The original valuation was made by six department heads based on the following considerations: Previous experience required or length of time needed to learn the job; hazards and working conditions; unusual effort required; accuracy and dexterity; education. Two charts were provided to illustrate the point evaluation method for establishing base rates. Chief factors considered are as follows: "Skill, training and experience; responsibility; physical requirements; and hazard." A com-

(*Continued on page* 68)

W. O. McMahon
Sloss-Sheffield Steel & Iron Co. and Treasurer of Birmingham chapter

R. C. Harrell
Stockham Pipe Fittings Co. and Vice Chairman of Birmingham chapter

C. B. Saunders
Tennessee Coal, Iron & Railroad Co. and Chairman of Birmingham chapter

R. L. Ogden
Stockham Pipe Fittings Co. and Chairman Plant Visitation Committee

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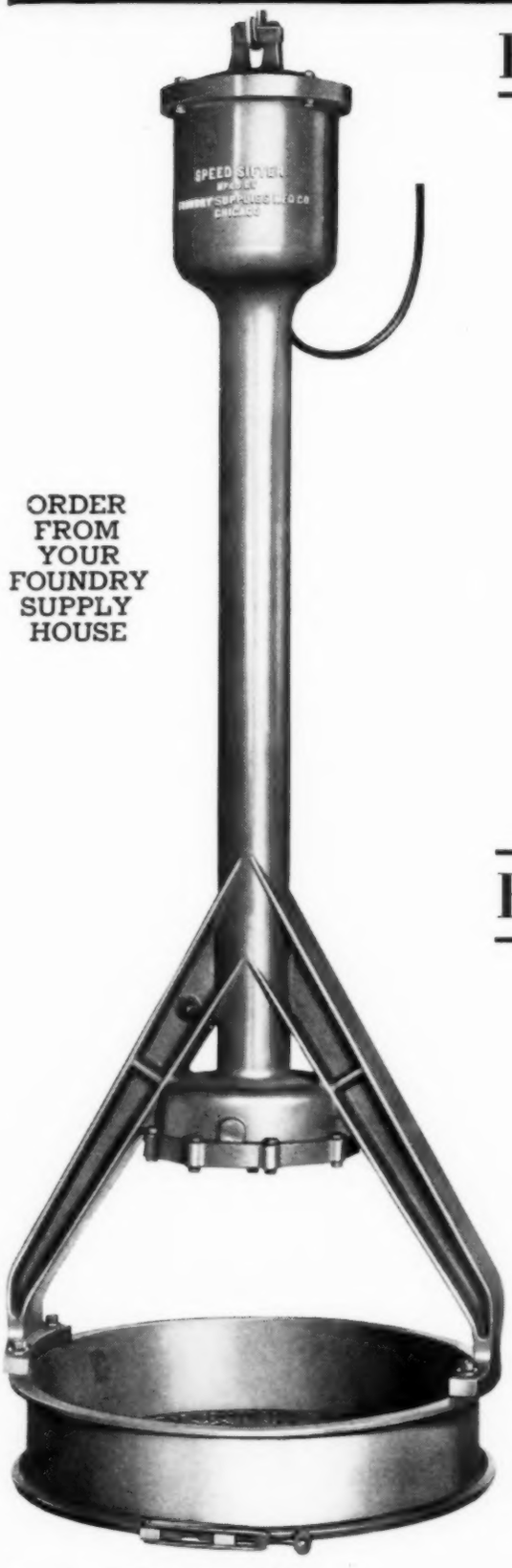

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It is easily handled by one man, weighs approx. 90 lbs., is 62 in. high overall. The one-piece frame of tough aluminum alloy makes for a remarkably effective vibration. Its smooth, free, rotary action vastly increases bearing life; all bearings grease packed. All mechanism of the ROTOPLANE is *completely* enclosed—no bearings or activating parts of any kind exposed to dust and grit.

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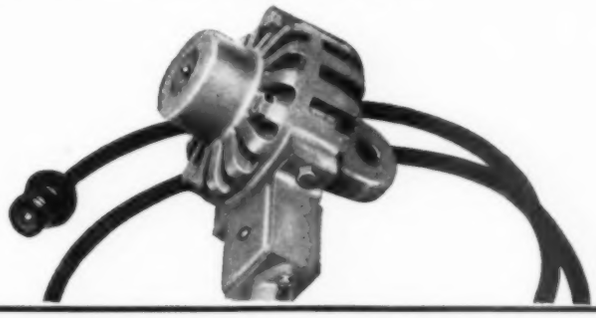

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True-to-pattern castings make satisfied customers . . . more repeat business. Increase your production and castings quality with RED Electric Vibrators. Sturdy, dustproof, lowest operating cost (electricity does not freeze). Unequaled for consistent year-'round results in foundries all over the world.

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No. 1—Light match plate work	$10.00
No. 2—Medium match plate work	13.00
No. 5—Heavy match plate, tub and bench work	17.00
No. 9—Machine and heavier work	24.00

Third (ground) wire per U. S. Govt. code—furnished with No. 9 at no extra cost; $1.00 extra with Nos. 1, 2 and 5 vibrators.

KNEE SWITCHES for operating Red Electric Vibrators: Single pole $3.00, Double pole $4.00.

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plete breakdown of subdivisions and points was illustrated.

The speaker criticized the policy of surrounding all wage scales with secrecy. That method of keeping down dissatisfaction in the lower brackets is not successful, for ill founded rumors nullify completely the intentions. The present trend of modern management is to inform employes more completely, not only on wages, but on other policies of the company as well. Mr. White believes best results are obtained by telling the new employe the wage range of the particular job and broadening the opportunities for promotion into higher paying jobs. In closing, the speaker stated a tactfully handled job evaluation program, which does not present drastic shakeups, and a gradual lining up of wages on a sound basis, will reduce turnover, increase production and stimulate smooth operations. An interesting discussion of several details of job evaluation procedure followed the presentation of the paper.

At the other sessions under the chairmanship of Dr. J. T. McKenzie, American Cast Iron Pipe Co., John W. Klein, Federated Metals division, American Smelting & Refining Co., St. Louis, presented an unusually interesting paper on the selection and uses of nonferrous alloys. In the speaker's opinion several factors must be taken into consideration in the selection of a suitable alloy. For example one has to know the physical properties required, tensile strength, elongation, brinnel hardness, possibly electrical or thermal conductivity.

Machining properties are of prime importance especially where careful machining and delicate tool finishing are required. Ease with which red brass can be machined is in odd contrast to the requirements of sharp tools and slow feeding necessary to prevent peening of high lead bronzes. Cost of an alloy is the third most important factor. However, he pointed out that the lowest price metal is not always the cheapest. Conversely, the most expensive metals is not necessarily the best under a given set of conditions.

Chart Showed Standard Alloys

Preprints of the paper distributed among the audience contained a chart showing standard alloys with their average analysis and physical characteristics, also many types of castings for which the alloys are suitable. For example castings under the heading red brass included valves, pump bodies, steam fittings, etc. However, the well known alloy 85-5-5-5, that is 85 per cent copper, 5 each tin, lead and zinc, is widely used for a wide variety of castings requiring the physical properties and machining characteristics of this red metal. The same is true of many other typical alloys. The chart showed the name of the alloy, red brass, gun metal, high lead bronze, bearing bronze, manganese bronze, aluminum bronze, yellow brass. The chart also showed typical uses for these metals, normal composition, ultimate tensile strength, elongation, brinnel hardness, pattern shrinkage allowance, pouring temperature, weight per cubic inch. In fact this chart amounts to a condensed encyclopedia on this phase of brass foundry practice.

The second section of the paper covered casting defects, causes and remedies. In many instances a defective casting is the result of a number of causes. Complaints can be remedied only by elimination. Usually answers to the following set of questions will reveal the cause of the trouble: Is the alloy suitable for the job in hand? Is the metal melted and poured at the proper temperature? Is the proper flux used? Is the molding practice correct, gates, risers, vents, etc? Is the sand suitable for the job? Are the cores made properly?

Phosphor-copper is the most widely used deoxidizing agent. From 1 to 2 ounces per hundred pounds of metal, depending on the alloy, are

(*Continued on page* 70)

Glimpses at Birmingham meeting. Illustrations courtesy O. L. Crocker and R. C. Harrell, Stockham Pipe Fittings Co., Birmingham

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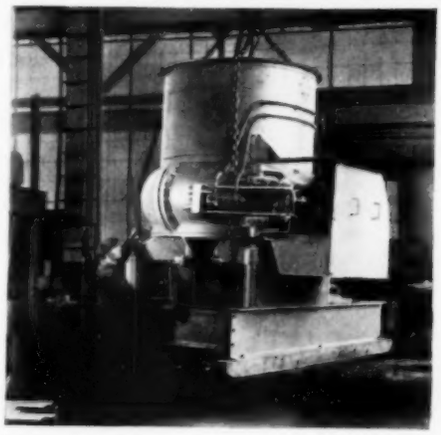

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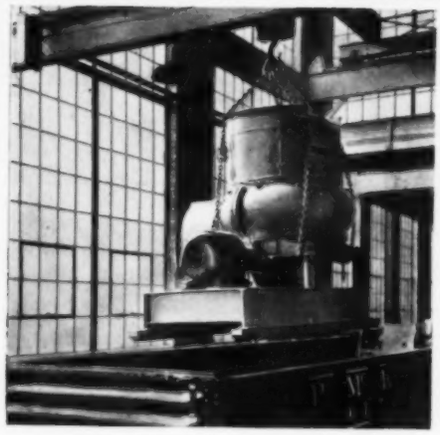

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THE SPEEDMULLOR CARAVAN has traveled thousands of miles, right into hundreds of foundries, to show how the SPEEDMULLOR can mull more facing, backing and core sand in less time and at lower cost. And this means sand of top quality and uniformly low temperature — sand that is properly prepared with a minimum of bond and moisture to insure low molding, cleaning and labor costs — sand that produces castings with satin-smooth surfaces . . . The "B & P" policy of "see before you buy" is your insurance against high molding costs and rough, dirty-face castings.

SPEEDMULLOR is installed without special foundation; discharge door may be located as desired.

SPEEDMULLOR uses less power per ton of sand mulled, because of high efficiency and brief mulling cycle.

SPEEDMULLOR has 3-point pressure oil pump lubrication; bearings and moving parts sealed against dust.

SPEEDMULLOR ready accessibility for lubrication and simplicity of construction assure long life and low maintenance cost.

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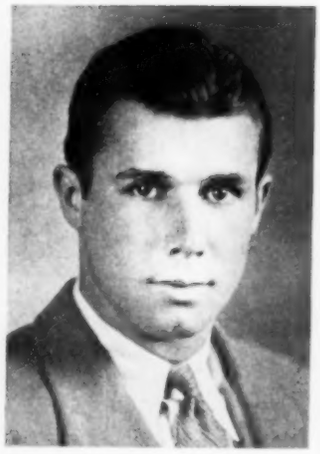

W. E. Jones
Stockham Pipe Fittings Co. and Chairman Program Committee

Wm. Oberhelman
Hill & Griffith Co. and Chairman of Entertainment Committee

A. S. Holberg
Alabama Clay Products Co. and Chairman Membership Committee

(*Concluded from page* 68)
added about 5 minutes before the crucible is removed from the furnace. The phosphor-copper should be plunged to the bottom of the crucible. Many foundrymen add 2 ounces of 15 per cent phosphor copper per 100 pounds of metal, in the bottom of the crucible before charging and 1 ounce about 5 minutes before commencing to pour.

Unsuitable sand, the speaker stated, undoubtedly is an outstanding cause of many foundry troubles. In a shop where ferrous and nonferrous castings are made, separate sands should be used. For the average brass casting made on a jolt squeeze machine, the moisture content will be between 7 and 9 per cent, permeability from 30 to 50. A chart accompanying the paper showed typical types of defects, causes of these defects and the suggested remedies.

Described Foundry Facings

The first session Friday after noon was devoted to a paper "Facings and Core Wash," by Edwin J. Klumb, Hill & Griffith Co., Cincinnati. J. E. Reynolds, U. S. Cast Iron Pipe Co., Bessemer, Ala., was chairman. Mr. Klumb first defined foundry facings as materials applied to or mixed with sand that comes in contact with molten metal. The classes of such products are plumbago, core wash, core blacking, mold blacking, heavy stove facing, return stove plate facing, shake bag facing, silica mold wash, talc or soapstone, sea coal and many others. The speaker then discussed these main classifications, giving information on the materials and the particular problems encountered in their applications.

Mr. Klumb stated the many changes in the foundry industry during the past few years has necessitated new types of facings and mold washes. Materials with high heat resistance and a high fusion point have been made necessary because of higher pouring temperatures. Increase in the use of steel in the cupola charge and the growing application of alloys require high quality facings to produce satisfactory results. Manufacturers of facing materials have been successful in providing materials to meet these needs.

At the 3 p. m. session Friday with J. M. Franklin, Central Foundry Co., Holt, Ala., in the chair, Pat Dwyer, engineering editor, THE FOUNDRY, Cleveland, presented a series of slides to illustrate his comment on the application and function of gates and risers in the production of castings. He claimed that in many instances the shape, size or position of the gate is immaterial. All that is required is an opening through which the metal may be spilled into the molds.

Discussed Gating Practice

In other instances these factors become extremely important and may be the deciding factor between perfect and imperfect castings. Other features touched upon included top and bottom pouring, closed and open risers, skim gates, speed of pouring, pressure, function of risers, causes of shrinks and draws, progressive solidification, experimental methods pursued by various investigators, roll casting practice with related discussion dealing with technique involved in the production of chilled castings of various types.

Necessity of the business man taking an active part in the political administration of the country if we are to come out of the slough of despond, balance the budget and once more flourish as a prosperous nation, was stressed by Donald B. Gillies, vice president, Republic Steel Corp., Cleveland, in his address as guest speaker at the annual banquet which marked the close of the conference Friday night. An entirely new factor in the general situation is the increasingly active part government is taking in business. An entirely new set of rules is being introduced. The business man does not know how to evaluate events and happenings as he did before the politician became such a prominent business regulator. In the old days he could look ahead with some degree of certainty, make at least a fair guess on what was going to happen and adjust himself in accordance. That cannot be done today because he does not know what kind of rules an administration, a legislature or a congress is going to lay down which may entirely upset his calculations.

Until some of the fundamental troubles in this country have been cured, the speaker claimed, it seems rather useless to talk about transient business recovery. We may have sudden upturns, but if the past few years are an indication, there will be corresponding downturns. Permanent recovery never can come until a smaller proportion of our national income passes through government hands and an increasing amount passes through the hands of business and industry.

We have something in this country, Mr. Gillies said, that is in danger and that is worth fighting for. The business man too long has stood on the side lines, cheering or condemning, as circumstances arose, and has taken too little part in creating the circumstances which will continue a system that will insure the welfare and well being of this country and the people living in it.

ADVERTISING PAGES REMOVED

Charging The Cupola

(*Concluded from page* 24)

tric yard and charging cranes. Probably a scale car and inclined loading bin and a simpler type of charging unit would be the maximum recommended under these conditions, although every detail should be studied with a view to getting maximum mechanization which operating conditions warrant.

It is obvious that in a large foundry with heavy daily tonnage a much greater degree of mechanization is justifiable than in a small plant with relatively short daily heats. A suitable balance must be maintained between investment cost of mechanical equipment and probable savings to be derived. To achieve that result the designer of the charging system must have a practical knowledge of the subject and extensive experience in solving such problems.

Without attempting to go into the relative merits of competitive equipment suffice it to say that there are certain definite benefits which any mechanical charging system should effect for the purchaser if he is to get value received for the money spent. In general these benefits are:

Cost reduction. Exact figures cannot be given on this item as no two foundries have the same conditions. Generally speaking, labor saving is one of the chief advantages of mechanical charging. In large plants handling heavy tonnage, the direct saving in labor alone is a sizable figure. In small plants that item may be less important but in all cases the work is made much easier and more agreeable for the men.

Fig. 6—Another type of mechanical charger, electrically operated, and using cone bottom buckets filled in the yard and brought to the cupola by car or conveyor directly below well in the charging floor

Better melting practice. This is one of the intangible benefits of all properly designed charging systems but an important factor nevertheless. Experience has shown that the greater care exercised in weighing charges accurately and the more scientific method of handling all details connected with the process of charging result in improved melting practice. Consequently supervision is simplified and the man responsible for the whole plant can devote a larger portion of his time to other departments. Repeated instances have occurred where the morale throughout the plant has been raised and a general improvement effected, all of which resulted in lowering the net cost of production.

Better working conditions. Removing the men from the charging floor immediately solves a real problem. Hand charging always is disagreeable work and in the summer months frequently presents a problem. Mechanical charging definitely solves that problem.

Safety. Elimination of manual handling of pig, scrap and other materials through installation of properly designed mechanical equipment contributes directly to the safety of all concerned. With no men on the charging floor, there is considerably less danger from overheating or from gas. Greater accuracy of operation follows adoption of mechanical methods, makes the work of the safety committee a great deal easier.

Eliminates expensive cupola building. With the mechanical charging methods today there is no longer a need for a separate cupola building or an expensive charging floor. Elimination of these items in many cases will pay for a charging system.

Experience also shows that good housekeeping and mechanical charging in the cupola department invariably lead to more efficient methods throughout the plant, thus improving the efficiency.

In the past 10 years much progress has been made by the builders of charging equipment and today a variety of tested designs adaptable to a wide range of requirements are available. A careful study of the whole problem might well be called a major duty of every foundry manager if he hopes to accomplish lowest production costs in 1939.

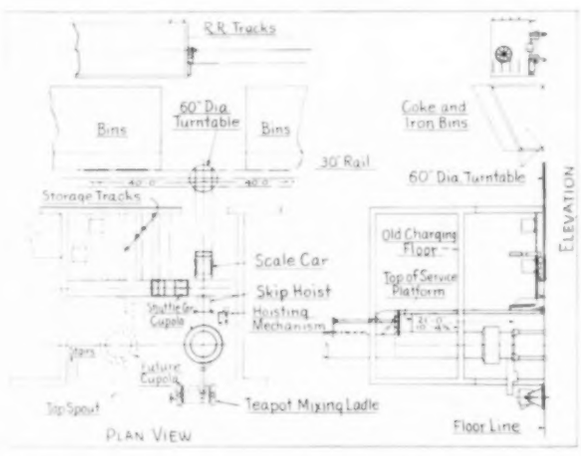

Fig. 7—Plan and elevation of charging system for small or medium foundry. Material stored in inclined bins is raked into skip buckets which are brought to loading point on hand operated scale car

Form Committee

Several technical societies and organizations engaged in the study of corrosion have joined in forming the American Co-ordinating Committee on Corrosion which is to serve as a clearing house and agency for information on experience and work in progress in corrosion and corrosion prevention. It is not the purpose of the committee to abstract the literature on corrosion. Next meeting of the committee will be held in June during the annual meeting of the American Society for Testing Materials at Atlantic City, N. J. The A. F. A. is represented by Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham.

Western division of American Mining congress will hold its 6th annual metal mining convention and exposition at Salt Lake City, Utah, Aug. 28 to 31, 1939.

Gray Iron Practice

(*Continued from page* 28)

those parts of the castings that must resist wear.

The malleable industry is making use of manganese in some short-anneal, pearlitic malleable where the quantity of manganese may be 1 per cent or more, primarily for the purpose of stabilizing carbides during the second stage of graphitization. During that stage of treatment, the pearlite is spheroidized, but the amount of combined carbon retained is sufficient to provide the iron with excellent strength properties. Forbes *Transactions,* A.F.A., 1938, has shown the value of manganese in spheroidized pearlitic malleable iron.

Similar effects of manganese have been noted in gray iron, where it has been found that high manganese contents, that is, manganese contents in the neighborhood of 1 per cent or over, have produced irons in which the tendency to form primary ferrite materially is suppressed. This does not seem to be generally appreciated, with the result that many other schemes have been tried to accomplish what probably can be done simply by raising the manganese content a trifle.

May Cause Trouble

Use of manganese in quantities somewhat above the normal percentages in gray iron seems to offer real opportunities to the foundry industry in its search for better castings. It is only fair to warn against a possible effect of too much manganese. In castings of thin sections, irons with around 1.5 per cent manganese have been reported to show a type of porosity that resembles subcutaneous blow-holes in gassy steels. Such porosity apparently does not occur in irons of lower manganese content or in castings of heavy sections of considerably higher manganese content.

Use of alloys in the gray iron industry began about 1918. Since that time, nickel chromium, molybdenum, titanium, vanadium, copper, and zirconium have been used quite generally by the industry. Most of the alloys refine the grain and graphite structure and by so doing improve the mechanical properties of iron. They can be grouped into those which are carbide formers, notably chromium and vanadium, and to a lesser degree molybdenum and manganese, and the graphite-forming elements which are nickel, titanium, copper, and zirconium.

Some help to stabilize the pearlite and, if used in sufficient quantities, tend to produce sorbite or martensite, or even to retain the austenite. The martensite and austenite formers are chiefly nickel, manganese, molybdenum, and copper, though some of these elements must be used in combination with others before they are effective. Calcium, titanium, and zirconium function primarily as so-called deoxidizers, for little of these metals remains in the iron in the metallic state.

Value of alloys, as pointed out by Merica *Transactions,* A.I.M.M.E., Iron and Steel division, Vol. 125, 1937, is principally that their useful effects are secured with less increase in chilling susceptibility and, therefore, less sacrifice of machinability. In the unalloyed iron it is not easy to choose a composition reasonably hard and strong in heavy sections, yet gray and machinable in light sections. By the use of alloys this situation is improved. Range of machinable hardness is widened by alloys. This is shown graphically in an illustration taken from the paper by Merica and reproduced in Fig. 4 on page 76 of THE FOUNDRY for March, showing the effect of alloys on widening the range of mechanical properties of pearlitic and machinable irons.

Superheating Has Place

A few years ago superheating was advocated strongly for producing the highest quality iron. While superheating was a benefit in many cases, some unfortunate experiences developed. In the low-carbon irons, particularly, superheating encouraged production of dendritic graphite which, when present, seriously affected the properties of the iron. Nevertheless, it has played an important role in improvement of iron from all types of furnaces. Its application to cupola practice had made possible production of irons which are now on a par with irons made in air and electric furnaces. But, even in cupola practice, use of superheating alone has not always led to success for reasons that are still not clearly understood.

To take full advantage of superheating, it has been found desirable to inoculate the iron in the ladle with materials such as calcium silicide, ferrosilicon, ferrosilicon-nickel mixtures, complex deoxidizers, and sometimes silico-manganese. Inoculation has proved beneficial and at the moment seems to be the only reliable way in which the structure of superheated iron consistently can be kept from becoming dendritic. One-half per cent of silicon as ferrosilicon, for example, withheld from the mix and added to superheated iron in the ladle, produced astonishing results.

Influence of ladle additions cannot be divorced from the influence of metal temperature. This is shown graphically in curves of Figs 1 and 3 on pages 26 and 27 of THE FOUNDRY for March, relating the properties of untreated and silicon treated cast irons to the temperature to which the irons were heated. These data were obtained on irons prepared in a high-frequency furnace from 125-pound charges melted according to schedule held as closely alike as possible and cast at 100 degrees Fahr. increments from 2350 to 3150 degrees Fahr. As each heat provided bars for three successive temperatures only, it was necessary for completing a series to prepare three identical heats of each iron. The irons heated below 2550 degrees Fahr. were cast immediately after being taken from the furnace, whereas those heated above 2550 degrees Fahr. were cooled to 2550 degrees Fahr. before casting.

Data are Compiled

In the accompanying table, page 28, are compiled data on the charge mixtures and the composition of the first iron taken from each heat. The carbon and silicon contents of all irons also are plotted in the figures. Ladle additions were equivalent to 0.50 per cent silicon in the case of ferrosilicon and 0.20 per cent silicon in the case of calcium silicide additions.

Modifications in properties of irons with metal temperatures and with ladle additions along with melting temperatures are in striking contrast. They emphasize the possibilities afforded gray iron foundrymen through control of melting for improving quality of product. Data in Fig. 1 apply specifically to high-frequency iron; yet a critical examination of available data on superheated but otherwise untreated irons shows a marked similarity in the relation of properties to metal temperature and the relation shown in the figure.

It is true not all these superheated irons show a minimum in tensile and tranverse strengths at 2650 to 2750 degrees Fahr. Some reach a minimum considerably above 2650 degrees Fahr., in which case the strength properties may show an increase with increase in temperature before, as well as after, the minimum is reached. Thus the curves may be shifted to the right or to the left for irons from different melting units, for example, but the general character of the curves remains the same irrespective of the type of furnace employed. Such variables as the nature of the charge as well as the furnace practice followed likewise are able to influence the relative positions of the curves.

Addition of materials as ferro-

(*Concluded on page* 76)

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(*Concluded from page* 74)

silicon and calcium silicide to the ladle exercises a potent and desirable influence on the properties of superheated irons, as is shown in Fig. 3. The effect on toughness, which is not shown in Fig. 3, is illustrated by the transverse-deflections of curves of Fig. 5. Here the toughness, expressed as the area under the curve, is somewhat more than twice as much for the silicon-treated iron.

While the change in properties with temperature for the untreated irons of Fig. 1 could be followed fairly closely by microstructures, which with increased metal temperature showed, first, refinement in the graphite flake, then the beginning of the formation of dendritic graphite with the appearance of ferrite patches, and finally the gradual disappearance of the ferrite and a steady increase in the amount of dendritic graphite, the change in properties for the silicon-treated irons of Fig. 3 could not be followed by microstructures as readily.

Noticeable effects of ladle additions on structure are reduction in size and influence on shape and distribution of graphite flakes. These effects may reach an optimum value fairly low in the metal temperature scale, so that continued improvement in the strength properties with metal temperature is unaccounted for either by further refinement in or by a more favorable distribution of the graphite. It would seem that some progressive change in character of the matrix with increased temperature also must take place, making the irons responsive to metal temperatures even though a casual examination of the microstructures does not reveal what this change might be.

Difference in microstructure of the untreated and the silicon-treated irons, as affected by metal temperature, may be demonstrated with the micrographs reproduced as Figs. 6 to 9 inclusive. The best irons are those which are silicon-treated. Nevertheless, there seems to be little in the microstructure to account for the rise in tensile strength from 43,000 to 51,000 pounds per square inch on raising the metal temperature from 2750 to 3150 degrees Fahr.

Effect of the ladle additions is explained by some as a deoxidizing effect, incorporating in this idea the thought that inclusions in the iron affect the mode of crystallization and distribution of the graphite during freezing. While this hypothesis, relative to the influence of solid or liquid inclusions, has widespread acceptance, particularly in England, there is yet no single proof that inclusions can function in a manner accredited to them.

Quite recent work by Boyles *Transactions*, A.I.M.M.E., Iron and Steel division, vol. 125, 1937, and *Preprint* No. 38-13, A.F.A., 1938, and others who melted iron in vacuum and in nonoxidizing gases, produced structural changes that would seem to throw doubt on the inclusion hypothesis. They have been able to obtain structures identical with structures that have been ascribed to the effects of inclusions, and yet there was fair evidence from their work that no solid or liquid oxide inclusions could exist in the iron. Hydrogen, directly or through its influence on sulphur or oxygen in solution in the iron, indirectly appears to have a profound influence on graphite separation.

The mere physical factor of wall thickness modifies the structure and properties of iron through their dependence on cooling rate. This is recognized by everyone in the industry, and provision is made to adjust the composition for different sizes of castings. This brings up the difficult question of the choice of the correct diameter of test bar that will represent a casting of a given wall thickness. Schwarz and Vaeth *Die Giesserei*, vol 20, 1933, showed that a plate casting r inches thick is represented by a round bar of $2r$ inches in diameter.

Not Always Valid

They found this relation to hold for sections up to 1.2 inches but that it only applied to simple designs. When the design was more complicated and the castings had cores, the conditions were altered. Even with thin walls, castings having cores were softer than normal, because the hot cores retarded cooling. In such cases the diameter of the test bar had to be increased very much if its properties were to represent the properties of the casting. High-strength irons are less affected by section changes than are the weaker varieties, while low-silicon irons are less sensitive to low cooling velocities than higher silicon irons. Alloys sometimes are used to modify cooling rate effects.

Mention should be made of a practice which, though still young, holds forth possibilities for improving gray iron. The duplexing of cast iron has for its purpose the production of high-test iron in quantity at low cost. Duplexing is primarily a refining operation where metal is taken from the cupola and heated in an electric or fuel-fired furnace to raise the mechanical properties. As a secondary result, the refining operation in some cases improves the machinability.

Frequently, no change in composition takes place, but often advantage is taken of duplexing to introduce alloy or to alter the base composition of the iron by adding cold metal scrap and ferroalloys. It affords a convenient means for producing a large variety of compositions from the same base cupola iron without necessitating change in cupola operation. On the basis of convenience and low operating costs, duplexing practices are expected ultimately to become commonplace in many foundries.

The author is indebted to Utilities Coordinated research who sponsored an extensive study on gray cast irons at Battelle Memorial institute for permission to publish data on the influence of metal temperature and ladle additions appearing in the tabulation and in Figs. 3 to 9 inclusive.

Iowa Offers Course On Time Study

University of Iowa, Iowa City, Iowa, is offering a special 3-week course from June 12 to 30, 1939 for plant managers, foremen, industrial engineers, cost accountants, and office executives on motion and time study. This course is intended for people interested in comprehensive training in motion and time study, waste elimination, cost reduction, plant layout and related subjects. The summer management course will be under the direction of Ralph M. Barnes, professor of industrial engineering, college of engineering.

Book Review

Proceedings of the American Society for Testing Materials, Parts I and II, 1388 and 674 pages respectively, 6 x 9 inches, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $9 each in cloth and in Europe by the Penton Publishing Co. Ltd., London.

These volumes constitute the *Proceedings* of the American Society for Testing Materials which is issued each year. Part I contains the reports of 53 standing, joint or sectional committees, and appended papers relating to committee work, and proposed standards, for information and comment. In addition the volume also includes all new or revised tentative specifications and tests acted on in 1938, and proposed revisions of standards. Part II is devoted to the technical papers presented at the annual meeting, and also includes the Marburg lecture on "The Torsion Test", and the Symposium on Impact Testing with 9 extensive technical papers.

Of the 33 other technical papers presented, 13 relate to ferrous and nonferrous materials, 8 discuss topics on cement, concrete, lime, ceramics, and masonry materials, and 12 cover other fields such as rosin, transformer oil, greases, highway materials, etc.

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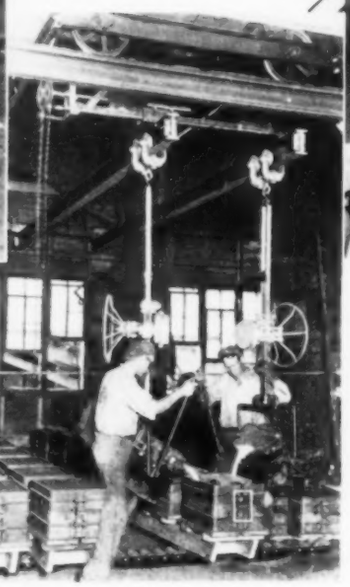

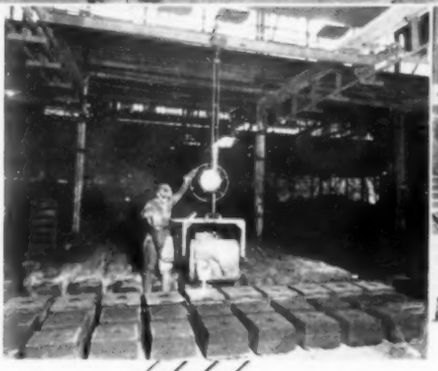

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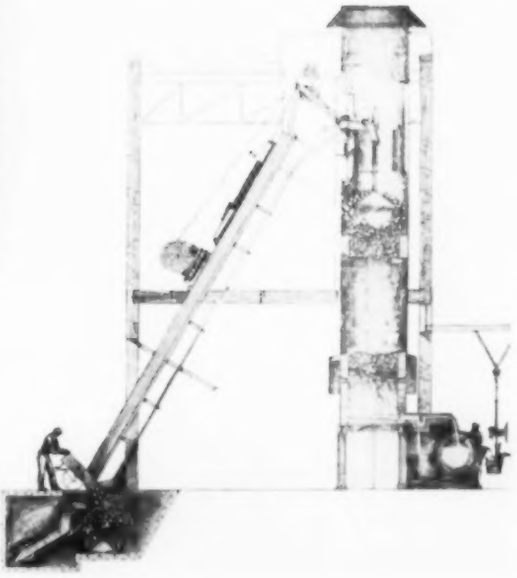

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Cincinnati Arranges Convention

(*Continued from page* 29)

nati, chairman; J. S. Turner, Cincinnati Convention bureau, Cincinnati, secretary; William Heilig, William Powell Co., Cincinnati; William H. Hoppenjans, Star Foundry Co., Covington, Ky.; William C. Scott, Williamson Heater Co., Cincinnati.

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The complete tentative program, recently announced by Norman F. Hindle, technical secretary of the A. F. A., contains an especially attractive group of splendid papers covering practically all phases of foundry practice in the four branches of the industry. The program will include the shop operation courses, which always have been extremely popular at previous conventions, a lecture course on elementary metallurgy and the use of the microscope, and sessions covering problems in malleable iron, gray iron, steel and nonferrous practice, materials handling, apprentice training, safety and hygiene, castability of metals, refractories, time study, sand research and foundry costs.

Conference chapter delegates will attend a dinner on Tuesday evening, and will discuss various phases of chapter activity. The annual dinner for engineering instructors also will be on Tuesday evening. The annual dinner of the association will be held in the Hotel Gibson on Wednesday, and this will be followed by a reception and dance arranged by a committee of the Cincinnati District chapter.

The tentative convention program is as follows:

Monday, May 15

Registration

Headquarters and Registration — Hotel Gibson.

10:00 a.m.—Opening Session.
Greetings.
Responses.

10:30 a.m.—Malleable Cast Iron.
Atmosphere for Malleable Iron Annealing—Their Properties and Application, by John Dow, Holcroft & Co., Cleveland.

White Iron for Malleablizing, by J. O. Klein, Texas Foundries Inc., Lufkin, Texas.

Comparison of Grinding and Shearing Gates on Malleable Iron Castings, by S. D. Martin, Saginaw Malleable Iron division, General Motors Corp., Saginaw, Mich.

10:30 a.m.—Nonferrous.
Production of Bronze Pressure Castings, by D. Frank O'Connor, Walworth Co., Boston.
Crucible Melting, by G. K. Eggleston, Detroit Lubricator Co., Detroit.

10:30 a.m.—Gray Iron Shop Course.
Charirman, R. F. Hine, Studebaker Corp., South Bend, Ind. Discussion leader, Donald J. Reese, International Nickel Co., New York.
Cupola Practice.

2:00 p.m.—Special Works Visit to Cincinnati Milling Machine Co.

6:30 p.m.—Malleable Round Table Meeting—Dinner Conference.
Chairman, L. N. Shannon, Stockham Pipe Fittings Co., Birmingham, Ala. Co-Chairman, P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill.
Informal discussion on current practices.

8:00 p.m.—Materials Handling.
Mold Equipment, by W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa.
Some Tests in the Effectiveness of Water under High Prsesure for Cleaning Castings, by R. Webster, Hydroblast Co., Chicago.

8:00 p.m.—Nonferrous.
Effects of Aluminum and Antimony on the Physical Properties of Red Cast Brass (85-5-5-5), by H. B. Gardner and C. M. Saeger Jr., Bureau of Standards, Washington.
High Conductivity Copper Castings, by Dr. A. B. Kinzel, Union Carbide & Carbon Research laboratories, New York.
Nonferrous division annual business meeting.

8:00 p.m.—Lecture Course.
Elementary Metallurgy and the Use of the Microscope, by R. M. Allen, Bloomfield, N. J.

Tuesday, May 16

9:00 a.m.—Gray Iron Shop Course.
Chairman, P. T. Bancroft, Moline, Ill. Discussion leader, M. A. Scott, Greenlee Foundry Co., Chicago.
Gates and Risers.

10:00 a.m.—Malleable.
Effects of Manganese on Second Stage Graphitization, by D. P. Forbes, Gunite Foundries, Rockford, Ill.
Occurrence of Hydrogen in White Cast Iron, by H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland.

10:00 a.m.—Gray Cast Iron.
Scientific Approach to a Foundry Problem, by L. A. Danse, Cadillac Motor Car Co., Detroit.
Sixty Thousand Pound Cupola Iron, by E. L. Roth, Motor Casting Co., Milwaukee.
Castings for the British Gas Industry, by F. Whitehouse, Newton, Chambers & Co. Ltd., Chapeltown, England. (Exchange paper—Institute of British Foundrymen.)

10:00 a.m.—Nonferrous.
Nonferrous Founding, by M. G. Corson, New York.
Influence of Pouring Ladles on Quality of Red Brass, by R. W. Parsons, Ohio Brass Co., Mansfield, O.

10:00 a.m.—Apprentice Training.
Apprentice Training, by Herman K. Ewig, Cincinnati Milling Machine Co., Cincinnati.
Apprentice Training, by M. J. Gregory, Caterpillar Tractor Co., Peoria, Ill.

12:00—Joint Committee on Foundry Refractories—Luncheon.

12:30 p.m. — Nonferrous Round Table Meeting—Luncheon.

2:00 p.m.—Safety and Hygiene.
Establishment of a Safety and Hygiene Program in a Small Plant, by Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, O.
Management's Responsibility in the Safety Problem.

(*Concluded on page* 80)

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1939-1940 Edition of

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(*Concluded from page* 78)

2:00 p.m.—Castability of Metals.
Castability of Cast Steel, by C. H. Lorig and E. C. Kron, Battelle Memorial institute, Columbus, O.
Effects of Superheating on the Castability and Physical Properties of Gray Iron, by N. A. Ziegler and H. W. Northrup, Crane Co., Chicago.
Measurement of the Fluidity of Aluminum Alloys, by L. W. Eastwood.
Malleable Iron Castability Tests, by E. J. Ash, University of Michigan, Ann Arbor, Mich.
4:00 p.m.—Lecture Course.
Elementary Metallurgy and the Use of the Microscope, by R. M. Allen.
6:00 p.m.—Engineering Instructors' Dinner.
6:00 p.m.—Conference of Chapter Delegates—Dinner.
8:00 p.m.—Refractories.
Refractories in the Steel Foundry, by A. V. Leun, Bethlehem Steel Co., Bethlehem, Pa.
Plastic Cupola Patching, by R. E. Wilke, John Deere Tractor Co., Waterloo, Iowa.
8:00 p.m.—Time Study.
Practical Approach to Motion and Time Study, by G. J. Stegemerten, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Wednesday, May 17

8:00 a.m.—Gray Iron Shop Course.
Chairman, K. H. Priestley, Eaton-Erb Foundry Co., Vassar, Mich. Discussion leader, J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala.
Cupola Refractories and Figuring Mixes.
9:00 a.m.—Gray Iron.
Influence of Undercooling on the Graphite Pattern of Gray Iron, by R. Schneidewind and C. D'Amico, University of Michigan, Ann Arbor, Mich.
Temperature Measurements in Experimental and Commercial Foundries, by F. Holtby, University of Minnesota, Minneapolis.
Copper-Aluminum-Silicon Alloy Additions to Cast Iron, by V. H. Schnee and T. Barlow, Battlelle Memorial Institute, Columbus, O.
9:00 a.m. — Foreman and Apprentice Training.
Apprentice Training, by A. R. Luebke, Fairbanks Morse & Co., Beloit, Wis.
A Foundryman's Approach to Foreman Training, by W. G. Conner Jr., Walworth Co., Greensburg, Pa.
9:00 a.m.—Steel.
High Alloy Steel Castings for Heat and Corrosion Resistance, by James Corfield, Michigan Steel Castings Co., Detroit.
Report of Committee on Heat Treatment.
Report of Committee on Radiography.
Copper as an Alloying Element in Some Cast Steels, by C. T. Greenidge and C. H. Loring, Battelle Memorial institute, Columbus, O.
9:00 a.m.—Sand Research.
Properties of Resin Bonded Cores, by Emile Pragoff Jr., Hercules Powder Co., Wilmington, Del.
Hot Strength and the Role of Break Down of Cores, by Harry W. Dietert, Harry W. Dietert Co., Detroit.
11:00 a.m.—Annual Business Meeting and Board of Awards Lecture.
2:00 p.m.—Steel.
A Rapid Method for Determining Carbon in Plain Carbon Steels for Control Purposes, by H. H. Blosjo, Minneapolis Electric Steel Foundry, Minneapolis.
A Discussion on Steel Castings Having High Mechanical Properties, by Georges Delbart, Societe Francaise de Constructions Mecaniques, Paris, France. (Exchange paper—Association Technique de Fonderie de France).
Synthetic Bonded Steel Molding Sands, by C. W. Briggs, Steel Founders' Society of America, Cleveland, and R. E. Morey, Naval Research laboratory, Washington.
Report of Committee on Impact Tests.
Report of Committee on Coupon Tests.
2:00 p.m.—Sand Research.
Elements of Petrographic Study of Molding Sands, by R. E. Grim, Illinois Geological survey, Urbana, Ill.
Mineral Composition and Textures of the Clay Grade of Molding Sand, by C. E. Schubert, University of Illinois, and R. E. Grim, Illinois Geological survey, Urbana, Ill.
Report of Sand Research Committee.
2:00 p.m.—Foundry Costs.
Molding Costs—Committee Report.
Melting Costs—Committee Report.
4:00 p.m.—Lecture Course.
Elementary Metallurgy and the Use of the Microscope, by R. M. Allen.
7:00 p.m.—A. F. A. Annual Dinner.

Thursday, May 18

9:00 a.m.—Gray Iron Shop Course.
Chairman, J. A. Woody, American Cast Iron Pipe Co., Birmingham, Ala.
Cupola Operation, by John Lowe, Lansing, Mich.
9:30 a.m.—Steel—Symposium on Melting Practices.
Acid Electric, by W. G. Einster, Reading Steel Castings division, American Chain & Cable Co., Reading, Pa.
Basic Electric, by C. W. Briggs, Steel Founders' society, Cleveland.
Basic Open Hearth, by J. W. Porter, American Steel Foundries, East Chicago, Ind.
Acid Open Hearth, by W. C. Harris, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Converter, by F. B. Skeates, Link-Belt Co., Chicago.
Induction Furnace, by G. F. Landgraf, Lebanon Steel Foundry, Lebanon, Pa.
10:00 a.m.—Gray Iron.
Some Factors in Hardening and Tempering Gray Cast Iron, by V. A. Crosby, Climax Molybdenum Co., Detroit.
Effects of Heat Treatment on Combined Carbon and Physical Properties of Cast Iron, by S. C. Massari, Association of Manufacturers of Chilled Car Wheels, Chicago.
Influence of Compositioin on Electric Furnace Irons, by R. G. McElwee, Vanadium Corp. of America, Detroit, and R. Schneidewind, University of Michigan, Ann Arbor, Mich.
10:00 a.m.—Pattern Making.
Some Pattern Making Problems, by J. A. Kolb, Caterpillar Tractor Co., Peoria, Ill.
12:30 p.m.—Gray Iron Round Table Meeting—Luncheon.
12:30 p.m.—Steel Division Round Table Meeting—Luncheon.
Discussion Leaders: C. E. Sims, Battelle Memorial Institute, Columbus, O., and A. P. Gagnebin, International Nickel Co., Bayonne, N. J.
Deoxidizers.
Discussion Leaders: D. C. Zuege, Sivyer Steel Casting Co., Milwaukee, and H. H. Blosjo, Minneapolis Electric Steel Casting Co., Minneapolis.
Reduction of Silicon from Slag.
2:00 p.m.—Lecture Course.
Elementary Metallurgy and the Use of the Microscope, by R. M. Allen.

Made Sales Agents

Hickman, Williams & Co., recently have been appointed exclusive sales representatives for foundry and domestic coke produced by the Citizen Gas & Coke Utility, Indianapolis. Hickman, Williams & Co. also have opened an office in Indianapolis, 805 Majestic building in charge of A. E. Murphy.

Regional Meeting Is Held by A.S.T.M.

Two extensive symposiums on thermal insulating materials and on lime featured the 1939 regional meeting of the American Society for Testing Materials held in Columbus, O., March 8 during the A.S.T.M. committee week which extended from March 6 to 10.

Subcommittee VIII on steel castings of committee A-1 on steel recommended adoption as standard, the specifications covering carbon steel castings for miscellaneous industrial uses, A-27. The committee also submitted to committee A-1 on steel new specifications for carbon steel castings for miscellaneous industrial uses suitable for fusion welding. The specification covers eight grades of material.

Subcommittee on copper-base alloys for sand castings of committee B-5 on copper and copper alloys, recommended for adoption revisions of specifications for manganese-bronze ingots for sand castings (B-7) and for manganese-bronze sand castings (B-54), and approved a new revision to provide for inclusion in those requirements for a high tensile strength manganese-bronze alloy.

Subcommittee X of committee A-10 on iron chromium and related alloys has recommended adoption as standard with minor revisions, eight existing specifications for various types of chromium-nickel alloy steel castings. These include all of the castings in charge of the subcommittee except for 12 to 14 per cent chromium. The latter is being held as tentative pending consideration of adding another composition grade.

Committee A-7 on malleable iron castings recommended adoption as standard the tentative specifications for cupola malleable iron. Proposed specifications for pearlitic malleable iron were discussed, and approved for a letter ballot vote.

Subcommittee on car wheels of committee A-3 on cast iron presented a progress report, and the group concerned with chilled iron announced that it was conducting an investigation of tension test specimens. Subgroup in charge of work on impact testing plans to submit for study and comment a drawing of a proposed impact testing machine. The newly formed subcommittee on soil pipe plans to modify the A.S.T.M. specifications to bring them in line with requirements set up by certain committees functioning under the sponsorship of the American Standards association. Action was taken to carry on the investigation of overstressing cast iron in the 20,000 and 50,000 pounds per square inch classes.

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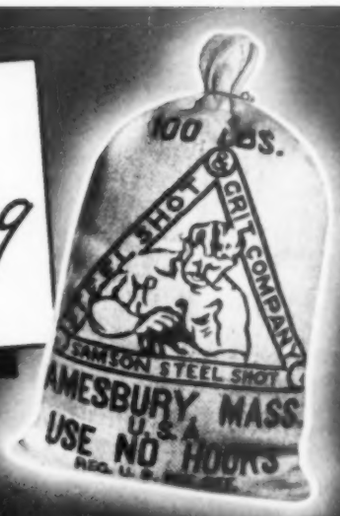

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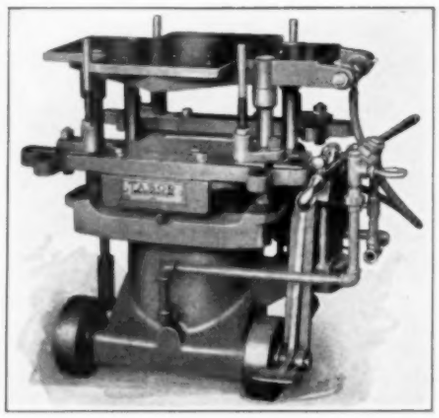

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Specs

(*Continued from page* 31)

similar classes in 49Sli, since those steels are intended to be welded, (or welded to), and the carbon must be kept low enough to guard against possible hardening in the welding process. By suitable heat treatment, steels too high in carbon to be safely welded might be made to meet the physical properties specified for these grades, and without a maximum carbon figure, they could not be barred out.

Class O in QQs681a and class C in 49Sli, with maximum carbon limits of 0.45 per cent and 0.40 per cent commonly are accepted without physical tests, so that prescription of maximum carbon is justifiable as not strictly a *how* clause, but rather a *what* requirement. The other cases where maximum carbon is prescribed in the government specifications always have seemed entirely unnecessary. Evidently they are based on the mistaken notion that to guard the government against errors of inexperienced foundries with whom orders are placed on a price basis, it is necessary to set up such definite limits that the wrong materials can not be supplied.

Are Made Burdensome

This laudable ambition to make the specifications fool-proof often leads to making them so burdensome that reliable concerns either will not bid on government requirements, or else protect themselves against the increased costs resulting from these unnecessary clauses by bidding high. As a result of the imposition of maximum carbon limits, the foundryman often finds himself in hot water when a heat, made low in carbon to suit government specifications has to be used also for other castings ordered to physical properties difficult to secure within the limits of the government requirements.

If by suitable heat treatments, steel of somewhat higher carbon can be given the physical properties desired, what adequate reason really exists for barring it out, simply because though it meets the *what* clauses, it does not conform also to the *how* clauses?

Divergencies in the physical properties specified in the different specifications are brought out sharply both in the tabulation by tensile strength and in the chart. Especially is this true of the 70,000 pounds per square inch tensile strength class, which includes a large proportion of the cast steel manufactured today. In this class the prescribed yield point varies from 35,000 pounds per square inch in the A.S.T.M. A27-36T, class B2, annealed, to 40,000 pounds per square inch in QQS 681a, class 2, annealed.

At the same time, the elongation and reduction of area called for in these two classes vary from 20 and 30 per cent in the A.S.T.M. specification to 24 and 30 per cent in the latter. Three other grades, it will be noted, call for 24 and 36 per cent for these properties. Lack of consistency in these varying requirements is obvious. Of course the higher physical properties in QQS-681a class 2 might be justified on the ground that the service for which these castings are used demands a higher grade and a stronger steel.

However, as this is a grade intended for welding, in most cases used after stress relief, higher properties would in general seem to imply a steel nearer the upper limits of the analysis range, and hence more prone to harden unduly near the weld, so that the lower properties would appear more desirable.

Multiply the Classes

Finally, both A27-36T class B2 and QQS681a class 2 are supposed to be heat treated by full annealing, with identical minimum tensile strengths. It would seem as if the other properties also should be in agreement, unless the intention is to force the carbon to the upper side of the prescribed range in the government specification—or else to lower the carbon and secure higher properties by taking advantage of the sliding scale arrangement for manganese content, and the fairly high permissible limits for copper and nickel.

Multiplicity of classes in A.S.T.M. specification A27-36T always has seemed a mistake, based though it is on the desire to include every class that any purchaser may happen to be buying. The list is even more confusing than appears from the chart and tabulation, since in addition to the ten classes on which physical tests are demanded, there are two more, numbered N1 and N2, covering castings purchased without test. This total of ten classes in a single specification seems hard to justify.

This particular specification includes one class of cast steel that is a lonesome example of what might be called maker-dictated properties, truly a rare phenomenon in most current specifications. This covers certain exceedingly large and heavy castings, many of which cannot be annealed in any existing foundry annealing furnaces, so that they are used in the as cast condition. The analysis of the steel in these big castings is maintained within a range that experience has shown to result in castings that give satisfactory service, and the properties called for are necessarily those characteristic of such a steel in its untreated condition.

Users of these parts have found the service of their equipment so much improved over what they were able to secure formerly, using assemblies of smaller castings, that they are for the most part anxious to use the big one-piece jobs. Naturally, therefore, the buyers are not in a position to do anything but accept the range of physical properties that experience has shown are characteristic of the material.

Quite a different picture is exhibited by classes A2 and A3 of this specification, with identical tensile strength and yield point, and elongation and reduction of area varying by only 2 per cent and 3 per cent respectively. What possible justification there is for the existence of two such closely similar classes, is something of a mystery.

Remembering the circumstances under which this specification was drawn up and adopted, one is led to suspect that the continued existence of the two classes reflects simply inability to secure agreement between purchasers of castings of similar quality, some of whom were disposed to demand higher properties than the others, and were willing to permit normalizing to secure the better figures.

Feeling of Confusion

The same thing is true to a certain extent of three B and two A grades, in which the differences are quite small. All-in-all, one who did not take part in the deliberations leading up to the adoption of this specification may be pardoned for feeling confused by the multiplicity of types, and for wishing to see a compromise arrived at that will permit considerable simplification.

Of the miscellaneous requirements, that of annealing lugs on castings is one that would seem to contain the germs of disagreement between buyer and seller. When only full annealing of these castings was practiced, of course, the fracture of lugs at different parts of the casting was a good indication of the uniformity of the annealing, at least as far as reaching the proper temperature was concerned. With more complicated heat treatments, such as normalizing followed by a draw, the fracture of such lugs indicates little more than that the steel has been heated above the critical range at some stage of the process.

As to whether the cooling after the first heating has been effective in raising the tensile properties,

(*Continued on page* 85)

ADVERTISING PAGES REMOVED

(*Continued from page* 82)

and whether the draw has been at a proper temperature and for a proper length of time, annealing lugs give no indication whatever. As heat treatments other than full annealing more widely are adopted, it would seem as if annealing lugs would gradualy fall into disuse.

The *test to destruction* of small castings is another requirement over which there has been a good deal of disagreement and discussion. The A.S.T.M. and the A.A.R. say "This test shall show the material to be ductile, free from injurious defects, and apparently suitable for the purpose intended". The existence of injurious defects, of course, may or may not be disclosed by the rather haphazard method of pounding a casting with a heavy weight until it is smashed into a cocked hat and broken at various points.

Suitability Is Questioned

The assumption, of course, is that injurious defects will cause fracture to occur where the defects are located, and to quite an extent this is true. Ductility also is indicated, at least to some extent, by the amount of mauling the piece will take before it breaks, and how it fails. Suitability for the purpose intended is hardly to be inferred from such a test, especially in these days when it has been demonstrated that various castings used for parts of machines give excellent service, although they are purposely made of metals that would not show to good advantage in a test to destruction.

It must be confessed that the test to destruction is a carry-over from days when but little was known about engineering materials, and engineers were willing to assume that if a piece would stand a bad mauling, it would not fail in service. Since this is in many cases not true, the test to destruction would appear to be obsolete, or at least obsolescent. The *apparently*, before *suitable for the purpose intended*, was an addition to the language of the older clause for the purpose of making it sound more sensible, but even with this change, the interpretation of the test is open to so much challenge as to make its usefulness exceedingly doubtful in the majority of cases.

Some of the requirements with regard to welding, if carried out literally, would lead to a lot of useless expense. On small and light castings, and for minor welds, to supply inspector in each case with the full analysis and a description of the type of filler rod and the welding technique to be followed, obviously would demand an army of clerks keeping track of the identity of the castings. The same thing is true of the requirement that heat numbers be stamped on all castings over 5 pounds in weight, as called for in QQS681a. This stamping requirement surely seems like a useless expense in many cases of small and unimportant castings, and only the exercise of common sense on the part of inspectors makes it possible to produce castings to these specifications that have over-nice requirements in the welding clauses.

Leads to Endless Delay

"Inspection in the green" is another favorite requirement of the government specification - writers which leads to endless delay in the execution of orders, without compensating advantages to the buyer. The idea, of course, is that inspection before any work is done on the castings in the cleaning room enables inspectors to see all defects that might be covered up in one way or another by dishonest producers, and never found if only inspection of castings ready to ship were demanded. Actually, of course, the dishonest producer will find ways to cover many of these defects so that they will not be visible in the green, so that the primary object of the clause is defeated, and only delay in getting work under way on the castings results from the retention of this requirement in government specifications.

Restrictions on normalizing, in QQS681a especially, with tensile requirements in some of the classes a shade above what can be secured in heavy castings by full annealing, has given rise to a great deal of difficulty in working to some of these government specifications. In some ways, of course, this may be considered a case of drawing limits for physical properties too high for the maker to meet with the analysis and heat treatment specified, and thus just another example of the unfairness of combining *how* clauses in a specification that prescribes physical properties that must be met.

Radiographic examination is another requirement in the government specifications that has been something of a bugaboo to producers. This method of examination is specified only when so stated in the order, and in those cases covers certain types of castings whose soundness is considered of vital importance. Where the trouble has occurred in some cases is in the dragnet clause that permits the buyer to impose radiographic examination in connection with permission to repair by welding.

So many cases occur where welds are considered important enough to justify radiographic examination that some shops feel they might as well count on a large majority of the pieces being subjected to x-ray or gamma-ray inspection. The uncertainty with regard to the interpretation of radiographic films and the tendency of some inspectors to demand that anything that looks like a major defect be chipped out, regardless of location, and repaired by welding, has led to a certain amount of apprehension on the part of foundrymen in bidding on government work.

A recent questionnaire conducted by C. W. Briggs, chairman of the A.F.A. committee on radiography, however, indicated that the fear of radiographic examination is greater on the part of those who have not had experience with it than in the case of foundries that have made castings to radiographic standards. Therefore, it looks as if in this case perhaps the bark is worse than the bite—but those bidding under QQS-681a and 49Sli need to keep in mind the possibility of the extra expense resulting from this feature of the specifications.

Of course, the growing use of radiographic examination of castings for high temperature fittings used in power house and oil refinery service also is gradually getting makers of high grade castings accustomed to that method of inspection, so that its use will undoubtedly become common practice in cases where soundness really is vital to service.

Test Too Sensitive

In addition to radiographic examination, the language of QQS681a permits the use of magnaflux testing, in connection with permission to repair castings by welding. This test consists of locating surface defects by magnetizing the pieces under examination, sprinkling on very fine iron particles, and noting the spots where the iron adheres to the castings. For the location of certain kinds of surface defects, such as incipient fatigue cracks in moving parts of machines, seams and hair-line cracks in forgings or rolled bars, improper welds in welded pipe, etc., the magnaflux test has been found very useful.

In the case of castings, it suffers from the difficulty that it is too sensitive, and locates surface imperfections often no more serious or important than superficial cold shuts and other discontinuities of no consequence, so that the foundries have felt justified in objecting strongly to the inclusion of that method of test in casting specifications. The rewrite of 49Sli which is now under consideration, is understood to omit reference to magnaflux by name,

though the phrase "x-ray, gamma-ray or other nondestructive test", which it is understood is included in the new draft, still holds the threat of its being imposed.

Sufficient has been said, it is hoped, to lead bidders on orders calling for specifications to *stop, look and listen* before naming prices, and to make adequate preparations to meet the requirements of the specifications, instead of waking up too late and putting it up to the unfortunate plant metallurgist to *get those castings through the tests*, when the existing conditions make his task impossible.

As indicated previously, it is understood that 49Sli is soon to be replaced by a new specification whose terms are to be based largely upon those of QQs681a. When the new text is distributed, the author hopes to contribute a few supplementary remarks to fill out this discussion on steel specifications.

Reader's Comment

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.*

He Smites the Lyre

TO THE EDITOR:

There once was a molder, let's call him Bill, who worked in a steel foundry at Carterville. He bummed right and left from friends until he drew down his pay on Saturday. He was known in shop and pub as Big Bill Kent. Once he left wife and kids and off he went. He hit the road, but home he never sent a cent of his pay on Saturday. His wife upbraided, pleaded, scolded in letters addressed to where he molded. He always replied "This place just folded. I get no pay on Saturday!"

Weeks went by then she wrote "Dear Bill: There are too many mouths for me to fill. We're leaving for the poorhouse over the hill. They'll make you pay on Saturday." This news shocked Bill. He went limp as leather. He wrote: "Regret you're at end of tether. Hold out one week and we'll all go together. They cut my pay on Saturday."

So he joined the horde of hobo molders. You know, one sided gait, hunched up shoulders, far off look as the wanderlust smolders as they finger a pay on Saturday.

In THE FOUNDRY the bo met Pat Dwyer's Bill. Regained self respect, likewise his good will. When he brought wife and family back over the hill and gave them his pay on Saturday.

For twenty years Bill has been philosopher and friend explaining to foundrymen the latest trend. Teaching them how to make their work transcend something more than their pay on Saturday. Because the foundry is dirty, let no one suppose with sand in our shoes and smoke in our clothes that we are supine and not up on our toes for things higher than pay on Saturday. Each month we wade through diagrams and graphs, stories and pictures and pithy paragraphs. Then the *Adventures of Bill* to give us the laughs like two weeks pay on Saturday. One last word to illustrator Richey. As you hold your pencil and your hand gets itchy, please keep Bill human. He couldn't be ritzy on a molder's pay on Saturday.

Perhaps this poetic urge may be the first sign of incipient senility like cutting out paper dolls or whittling on the back porch. Mrs. D. has suggested that I try a hair cut.

JOHN DUFFY

10410 *Avenue F.*
Chicago

Sulphur Pickup

TO THE EDITORS:

I am just a little bit behind on my reading, but I have come to the Questions and Answers section of the February number of THE FOUNDRY. On page 36 you say iron does not begin to pick up sulphur until it is in the molten condition. You are very obviously in error on this point as it can be easily proved by going to the nearest gas works where they use iron shavings to desulphurize the gas at atmospheric temperature. I am enclosing a copy of a paper by J. A. Bowers and myself in which you will notice Fig. 1 on page 310 of the reprint. The sulphur on the first few ladles of small coke is inordinately high on account of the long time the iron was in the stack before it began to melt. You will notice that the coke size has very little to do with it after the cupola really gets started.

JAMES T. MACKENZIE,
Chief Metallurgist
American Cast Iron Pipe Co.
Birmingham, Ala.

EDITOR'S NOTE—The paper referred to by Dr. MacKenzie was entitled "Cast Iron as Affected by Coke Size in Cupola Melting" and was presented at the Milwaukee convention of the A. F. A., May 4, 1937. The paper appears on page 293 of volume XLV, *Transactions* of the American Foundrymen's association.

A Simple Rig Takes Place of Lathe

By A. H. Waychoff

A young model maker, lacking a lathe, constructed the device shown in the accompanying illustration for producing lengths of straight, smooth, round wood stock. He glued sand paper on the two inner surfaces of a 2-foot length of common bed rail angle iron. The set screw in the crank of an old food chopper was replaced with a longer screw equipped at the upper end with a wing attachment. One end of the piece of wood to be processed is inserted in the crank handle opening and held firmly by the wing screw. The stick then is laid in the angle iron and revolved rapidly. The operator turns the crank with one hand and maintains a light pressure against the wood with the other hand. It is claimed the device is remarkably fast and accurate on pieces from ⅜ to 1-inch in diameter.

Piece of wood is revolved rapidly against sand paper surfaced angle iron

Book Review

Transactions of the American Foundrymen's Association, 1938, edited by R. E. Kennedy and N. F. Hindle, cloth, 948 pages, 6 x 9 inches, published by the American Foundrymen's association, 222 West Adams street, Chicago, and supplied to members for $3, and to nonmembers for $15.

This is the annual bound volume containing the various papers and reports presented at the 1938 convention of the association. It contains 45 papers and reports and the discussions which followed the presentations. The papers cover a wide range of subjects pertaining to various branches of the foundry industry including gray cast iron, steel, malleable cast iron, and steel. In addition the book contains discussions on foundry refractories, patternmaking, and materials handling. While many of the papers are technical, the practical side of the foundry has not been neglected. Every foundryman will find this volume a valuable addition to his library.

W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland, recently appointed the Snyder Engineering Corp., 2444 East Twenty-fourth street, Los Angeles, as representative. The Snyder company also maintains an office at 2027 Vallejo street San Francisco, in charge E. Underhill.

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This installation is an example of the limitless uses to which Curtis Air Hoists can be put even under unfavorable conditions. Simple in construction with only one moving part, Curtis Air Hoists are rugged and immune to injury from over-loads or bad atmospheric conditions. They can be operated with ease and accuracy by unskilled labor. First cost is low, the power consumption small, and upkeep negligible.

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What Causes Losses?

(*Continued from page* 33)

best design casting is the one in which all members progressively increase in thickness to one central location where a riser can be placed. The cheapest design is the one which presents the least difficulties and risks in manufacture and this is particularly true in the production of quality and pressure castings.

It is of utmost importance to provide for free flow of metals throughout the mold. If some parts of the casting are heavier than others, these heavy sections must be fed by metal through risers placed directly over the heavier section of the casting, to compensate for shrinkage during solidification. Final shrinkage is transferred from the casting to the riser, where the metal should be the last to solidify.

From the standpoint of correct solidification progress alone, the ideal method of introducing this metal is to pour from the top through the riser. The riser receives the last and hottest metal and consequently can supply the needed metal to casting members below. Errosive action, particularly of molten steel and the limitations of available molding materials make this method impractical in many cases.

Is False Economy

It is false economy to cut down on the number or size of risers in the manufacture of quality and pressure castings particularly in steel and bronzes. Early solidification of the metal in the gate results in the removal of the ferrostatic pressure which is also an item to be considered in proper feeding of the casting. Belief in the necessity of a riser in every mold still persists, but mass production methods have helped to explode it. In gray iron we can reduce risers to a minimum and very often eliminate them by properly controlling the flow of metal through the gating arrangements.

With heavy sections in inaccessible places where risers cannot function we must resort to the use of chills, either externally or internally. An external chill shaped to the contour of the casting accelerates the cooling and solidification of part of the casting. An internal chill, usually a piece of rolled metal of a composition similar to that of the casting, is placed in a relatively heavy section of the mold, so that the liquid steel completely surrounds it and in doing so accelerates the cooling and solidification of the metal at that point. Often chills are placed in cores to equalize the cooling rate on a heavy section.

Chills must be thoroughly clean to prevent undesirable chemical reaction with the molten steel. If molds are not poured reasonably soon after closing, the chills are likely to condense moisture and become rusty. When this occurs the liquid steel will not lie quietly against the chills, and gas pockets will be formed in the castings.

Shrinkage varies with the composition of the solidification range of gray iron. Any considerable change in either the silicon or carbon content will so alter the shrinkage that modification in gates and feeders becomes necessary to insure complete soundness in the casting.

DEFECTS	PROBABLE CAUSE							
SHRINKAGE CAVITIES	1		2	5				4
CHILLED EDGES	1		3	4		2		
SLAG INCLUSIONS				1	2			
SEGREGATION				1				
WARP			1					2
COLD SHUT			3	2	1	5	4	
DRIFT		1					2	
STRAINS		1					3	2
SWELL		2					1	3
MISRUNS			3	2	1		4	

Fig. 11—Chart of important defects

Composition of the metal must be in balance. An iron thrown out of balance, either by a high silicon or carbon content, will produce an open, porous structure particularly in heavy sections.

Solidification range of the metal, temperature at which the metal is poured, surface area or size of the gates affect shrinkage. Some foundrymen claim that a low temperature iron will prevent internal shrinkage. Other foundrymen state that high temperature will prevent internal shrinkage. It is possible that both of these statements are correct but apparently other important controlling conditions have not been stated.

Where the shrinkage section is far removed from the ingate, low temperature iron will eliminate shrinkage because the metal is near the solidification point. By reducing the gate area we can pour hot fluid iron so that it will be dull and consequently near its solidification point by the time it reaches the section of high shrinkage. Another method of eliminating shrinkage is to place the section near a heavy gate. Hot iron entering the heavy gate often will eliminate this shrinkage because the gate will act as a feeding riser.

Often the internal defect commonly called shrinkage may be caused by gas, either in the mold or in the core. The remedy is to vent the mold and cores properly. If the defect is definitely a shrink, recourse then is to change the gating arrangement, placing the ingate so that the point at which the shrinkage takes place will get comparatively dull metal. This is accomplished by gating as far from the seat of the trouble as possible. Generally the ingate is made as small as will run the casting. Therefore feeding is going on while the casting is being run. If that method of gating fails, the ingates may be placed near the heavy part and increased in size. The runner as well as the sprue also may be increased to act as a feeder.

If these methods fail, a riser is used. The riser and the openings from it to the castings are made as large as the casting will permit so that feeding takes place until the casting is set. A riser with a soft grade of iron may produce a coarse open grain structure where the riser is attached. In many cases this is undesirable and a chill is used to replace the riser. These chills are never a complete cure but considerable relief may be had from their use.

Dispense With Risers

If all previously described measures fail the casting is made in a high test iron or one having a low total carbon. Usually we can then dispense with risers and use common gating practice.

Tendency of iron to chill is another problem which confronts the foundryman. It is especially important in machining and usually takes place where a large amount of green sand surrounds a very thin section of the casting. This chilling tendency may be due to a nonuniform mixture coming from the cupola or by melting and pouring the iron cold or to other conditions, mostly atmospheric.

Where the iron shows a tendency to chill, ferrosilicon, or graphite may be added to offset this condition. Sulphur has a tendency to chill. High total carbon, low silicon iron or low total carbon, high silicon iron show similar degree of chill when temperature conditions are the same.

Even on the softest grades of iron on thin sections we run into this condition. The best remedy is to place a small run-off on the casting

(*Concluded on page* 90)

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(*Concluded from page 88*)

which easily may be removed at the shakeout or in the cleaning operations.

Another interesting segregation effect is from iron phosphides. In a heavy section high in phosphorus, some very liquid material arrives at the center of the casting. This segregation is particularly noticeable in castings inclined toward shrinkage. For example where analysis of the casting may show silicon 2.18 per cent, sulphur 0.108 per cent, manganese 0.52 per cent, phosphorus 0.65 per cent, the segregated area may show silicon 1.79 per cent, sulphur 0.085 per cent, manganese 0.50 per cent and phosphorus 2.08 per cent.

Entrained slag in the metal requires attention if we are to produce perfect castings. When the metal is quite cold considerable slag accumulates on the top of the ladle, and is rather difficult to remove. Metal of this kind shows aggregates of slag when poured into castings.

To overcome a slag condition of this kind it is necessary to restrict or choke the flow of metal at some point in the gating system so that the down gate can be kept full. It may be remedied by placing a slag or dirt catcher to restrict the flow of metal between the sprue and the mold cavity. These are only precautionary measures. The real solution is to melt the iron properly which readily will clear itself of slag without much difficulty.

Traces Cold Shuts

Cold shuts generally can be attributed either to pouring the iron cold or to an improper gating arrangement which allows the metal to enter the mold cavity in a stream entirely too small to run the casting properly. On some occasions a cold shut may be due to the accumulation of trapped gas in the mold. This generally occurs in thin sections and especially when the casting is in the cope.

Poor gating methods will produce defective castings even with the best grade of sand and with good sand properties, while a relatively poor grade may give satisfactory results with the proper gating.

Fig. 1 shows a typical gating arrangement for light castings used in the stove plate industry and in the manufacture of small light articles in general. The metal is choked at the sprue *A* while the reduced area *B* acts as a dirt catcher or skimmer. That type of gating insures a gentle entrance of the metal into the mold cavity. The runner generally is placed in the cope and the gates in the nowel. Placing the runner in the cope serves not only as a dirt catcher but also helps to feed the casting. The casting often may be made in the cope particularly on work requiring deep impressions to prevent a hanging cope. This particularly applies to some types of motor covers. In this gating arrangement finger gates often are used.

Fig. 2 shows another type of dirt catcher used in the light casting and automotive industry. Here again the mold is choked in the sprue but the ingate is fanned to produce a gentle flow of metal into the mold and to easily break off. This figure shows the gating arrangement of a brake drum. The dirt is held in the upper corner.

Pencil gates shown in Fig. 3 are used when it becomes necessary to force rapidly a considerable volume of metal into a thin casting. The principle is to break up the stream of metal and introduce it into the mold through many small openings. The pouring basin shown in this figure absorbs the shock of the metal.

Give Impartial Trial

In the majority of cases where top gates have proved disastrous an investigation will show that the casting defect was due to either erosion, causing the sand to wash, or to the steam generated by the heat of the metal. This type of gate should not be condemned carelessly without an impartial trial. It has been used for small gears or gear blanks over the hub to insure an even metal distribution. It also is used in gating fire pot castings, slag pots and many other types of castings weighing from 5 to 20 tons. Iron from the circular basin enters the mold through small pop gates spaced 12 to 18 inches apart. This type of gating is also used on large, flat, thin castings to prevent warping. It produces a more equalized heat throughout the mold.

Strainer cores shown in Fig. 6 are pencil gates in principle. Another advantage with this type of gate is that if the metal temperature is properly controlled less risers will be necessary.

Fig. 4 shows the general application of a bottom gate to hub or gear blanks. This is the general principle of casting the chilled car wheel from the bottom although the majority are gated on the top. In this type of gating it is essential that the center core is sufficiently large to prevent excessive expansion and contraction of the sand.

Fig. 5 shows a strainer core dropped into the sprue. Runner gates and strainer cores as shown in Figs. 5 and 6 regulate the speed at which iron enters the mold. When the metal is poured within a predetermined temperature range this speed of pouring automatically regulates the temperature of the metal rising in the mold. Controlling the temperature of the metal at the spout and the stream of metal entering the mold cavity eliminates many risers.

Fig. 6 shows a strainer core set to a little more exact requirements than in Fig. 5 and fixed with a pouring basin to control the flow of the metal into the mold cavity. This type of gating is used largely in the manufacture of friction disks. Fig. 7 shows a splash core often used in the gating of large and deep castings to prevent errosion of the sand. A pouring basin also is attached to absorb the shock of the metal. This is typical of large casting manufacture. Fig. 8 shows a typical strainer core set in a dry sand bottom and used in producing automotive castings. This strainer core forms part of the mold face and is good when flask equipment is not large enough for the castings produced. Fig. 9 shows a relief sprue designed to serve as a riser, trap, and dirt catcher. Fig. 10 shows a horn gate, a conventional form of gate employed where the casting can not be gated on the edge and where it is not advisable to pour iron down through the gate at the top. In this type of gate the area at *A* is sufficiently large to prevent a fountain effect which may be the cause of defective castings.

Horn gates may be formed in dry sand cores in halves and pasted. This type of gate allows a good flow of metal with the least turbulence and is used largely in pouring aluminum, manganese and silicon bronzes. It is used occasionally in gray iron. The reduced area at *B* acts as a dirt catcher and the area of the gate at *A* where the metal enters the mold cavity should be larger than the area at the point *B*.

The chart shown in Fig. 11 indicates some of the more important molding defects. The left column shows the castings defects caused by metal and molding while the right columns show the probable cause of these defects. The order in which they should be looked for is indicated by the numerals 1, 2, 3, etc.

Gray Iron Society To Meet in May

The annual meeting of the Gray Iron Founders' Society, Inc. will be held in the Netherland-Plaza hotel, Cincinnati, on May 15 at 10 a.m. according to a recent announcement of W. W. Rose, executive vice president of the society. All executive officials of gray iron foundries are cordially invited to attend this meeting.

ADVERTISING PAGES REMOVED

Wide Range Of Alloys Available

(*Continued from page* 34)

Silicon and aluminum both affect it adversely, causing it to be drossy and to have a tendency to leak under hydrostatic tests. Neither should be present in excess of 0.001 per cent. Antimony in excess of 0.25 per cent will increase hot shortness materially. Iron in excess of 0.15 per cent will increase the tendency to shrink during solidification and thus increase the demand for risers to feed the castings properly. It also will make the castings more drossy. Sulphur in excess of 0.08 per cent will affect materially the strength adversely. In fact, sulphur should be avoided as far as possible in all leaded bronzes if maximum strength is to be secured.

Are Slight Variations

Composition *RR* is a leaded bronze and is more or less a variation of composition *D*, previously discussed as steam or valve bronze. Likewise composition *SS* also is a variation of this same valve bronze. All three of these variations are used regularly for steam valves for medium or medium high pressures, and are covered by specifications QQB691 (a)1 by the federal specification board, and B30-36(1) by the A.S.T.M. These compositions do not demand the presence of phosphorus but phosphorus is permitted up to 0.05 per cent by the federal specifications and is used almost universally by all manufacturers of these compositions to deoxidize the metal properly during the process of manufacture.

Nickel frequently is added to these compositions, the federal specifications permitting up to 1 per cent maximum, and other private corporations' specifications permitting even more nickel when these alloys are used for the production of castings for some specific purpose. Nickel tends to refine the grain, increase density and also improve the physical strength if the alloy is well manufactured. It raises the melting point, if an appreciable amount is present, sometimes giving the foundryman difficulty on that account.

These alloys have excellent characteristics from the standpoint of resistance to leakage under hydrostatic tests since the ratio of tin to copper is such that the tin is usually all in solid solution, and not much, if any, of the secondary or delta constituent develops. Since there is so little delta constituent in this group of compositions, it is not essentially bearing metal, having no hard bearing crystal with which to resist wear.

Composition *TT* is a copper-tin bronze containing rather more lead than those previously described. It is a zinc deoxidized bronze, although many manufacturers do use some phosphorus to deoxidize the material during the process of manufacture. This composition is covered by A.S.T.M. specification B30-36(6) and is used commonly for automobile fittings, carburetor parts and the like, where stiffness and ease of machinability are important factors. If it is carefully manufactured so as to avoid any possibility of gassing and the castings have been properly fed by adequate risers, it will resist hydrostatic tests very satisfactorily.

Composition *UU* is a zinc deoxidized copper-tin bronze having a little less lead than composition *TT*, but having 1 per cent more tin which tends to harden the composition. It also has about 1 per cent more zinc. This is a good bearing bronze and while it does give some foundrymen difficulty, when properly made it gives extremely satisfactory results as a more or less general purpose bronze for a wide variety of different types of service. It also is used for valves and fittings. Presence of silicon in excess of 0.01 per cent and aluminum in excess of 0.005 per cent should be avoided where resistance to leakage is required.

Will Produce Dross

Presence of either of these or both in this composition will cause drossy and unsatisfactory looking castings. Iron in excess of 0.25 per cent will tend to increase the demand for risers to compensate for the shrinkage during solidification. It also will cause tendency to dirty castings. Antimony in excess of 0.25 per cent is said to cause some tendency toward hot shortness. Sulphur in excess of 0.07 per cent should be avoided if best results are to be secured.

Composition *VV* is a straight copper-tin lead bronze and should be deoxidized with phosphorus and a definite trace of phosphor should be present in the resulting alloy. This is a delicate alloy to produce in that it must be well deoxidized and must be poured correctly as regards temperature. It is used regularly for gears and bearings. Since this bronze contains an appreciable quantity of lead, it is somewhat more conformable than the usual gear bronzes of straight copper-tin and therefore, is used in castings where a little more conformability is desired than would be the case with the usual worm gear alloy of 89 per cent copper, 11 per cent tin. By comparison of the physical characteristics of this alloy with those of composition *II* the difference will be evident regarding their physical characteristics insofar as they are affected by the change in composition.

Composition *WW* is essentially a relatively high tin bronze with an appreciable percentage of lead but deoxidized with zinc instead of with phosphorus. However many do have some phosphorus in this composition and almost every foundryman in making it from new metal deoxidizes the copper with phosphorus in the form of phosphor tin or phosphor copper before adding the white metals. It is a good bearing alloy, having many characteristics that are peculiar to the high tin bronzes but also having some characteristics indicated by the physical properties shown in tables previously presented in this series of articles, that are the result of the presence of an appreciable percentage of zinc, as compared with the pure phosphor bronzes, such as *II* or *VV* and the like.

Contains Lead and Zinc

Since both lead and zinc are present in this bronze, it does give some manufacturers more difficulty in making good castings of salable appearance than is the case where a strictly phosphor bronze alloy is used containing no zinc but some phosphorus and only copper, tin and lead. To secure the best appearance, it is not desirable to have an appreciable percentage of phosphor present in the final alloy as phosphorus and zinc in the same composition do tend to form a scum or drossy appearance on some castings of irregular shape.

Antimony should not be in excess of 0.25 per cent. Iron in excess of 0.15 per cent will tend to increase the shrinkage, and will require an increase in size of risers to secure sound castings. An appreciable amount of iron in these compositions tends to cause a dirty appearance on the skin. If the castings are to be sold in the rough, this is objectionable. Sulphur in excess of 0.08 per cent tends to cause a loss in strength and silicon in excess of 0.01 per cent or aluminum in excess of 0.005 per cent will tend to cause leakage if the castings are to be used where resistance to leakage is a factor. This type of alloy commonly is used for pump bodies, bearings and some types of gears.

Composition *XX* is essentially a high tin bronze deoxidized with zinc and containing a small amount of lead. The lead content is just sufficient to make machining a little simpler than is the case where a strictly lead free alloy is used. This composition differs from *WW* by a reduction in the lead content and an increase in the tin content. Increase

in tin tends to harden the alloy materially, and since the lead content also has been reduced, the brinell hardness naturally would increase a little more than is accounted for by 1 per cent of tin.

This is a good gear bronze requiring careful control to maintain true analysis. Many manufacturers in producing it from new metals deoxidize the copper with phosphorus in the form of phosphor-copper or phosphor-tin before adding the white metal in spite of the fact that it is presumably deoxidized by the presence of 2 per cent zinc.

However, like *WW* there should not be enough phosphorus used to permit an appreciable amount of it to be present in the final product, since the phosphorus and zinc in the same alloy do give trouble as outlined in the discussion of composition *WW*. This composition really is the old fashioned 88-10-10 alloy hardened with a little increase in the tin and yet made a little more machinable by the presence of 0.5 per cent lead, thus making the chips more brittle.

When properly made it will take a beautiful finish and may be polished to a high degree. As in the case of composition *WW*, the impurity values should be controlled carefully if the best results are to be secured. Limits listed for composition *WW* are suggested as being applicable to composition *XX* as well.

Is Phosphor Bronze

Composition *YY* is a true phosphor bronze and is to all intents and purpose composition *II* with the addition of an appreciable percentage of lead, namely 1¼ per cent and 1 per cent nickel. Lead and nickel replace an equivalent amount of copper in the composition. The alloy is a gear bronze but since it contains lead, it is a little more conformable than is the case with the worm gear bronze *II*. Since it also shows 1 per cent nickel, it has characteristics that are peculiar to compositions having appreciable quantities of nickel present. This composition specifies, as indicated, 0.25 per cent phosphorus.

That would presuppose the addition of enough phosphorus to the copper during the process of manufacture to deoxidize properly the copper and entire composition and yet have a residual of 0.25 per cent phosphorus left in the final composition. The phosphorus accomplishes the dual purpose of deoxidizing the metal and also forming a definite compound in the resulting material, thus affecting its physical properties by the presence of this compound.

If this material must conform to physical test figures indicated in Table IV, care must be exercised in its manufacture and the control of impurities must be such that each and all of the different heats that are produced do not vary within reasonable limits so that tests of average heats will indicate average conditions. Iron above 0.15 per cent will tend to increase the shrinkage of this alloy and will require larger risers. It will also tend to cause discoloration of the surface to some extent.

Antimony above 0.25 per cent tends to cause hot shortness. Sulphur above 0.08 per cent reduces the strength characteristics and silicon above 0.01 per cent and aluminum above 0.005 per cent are not desirable if the material is to be subjected to hydrostatic service where leakage is a factor, since the presence of either or both of these elements tends to cause leakage.

This bronze is used frequently for worm gears, spur gears, pump bodies in which the body also must be the bearing for the shaft and many other places where both bearing and strength requirements are important factors. Due to the presence of the nickel, this alloy has higher strength characteristics and is more dense than a similar bronze without nickel.

Choose Mating Material

These characteristics developed by the presence of the nickel also require intelligent application of the mating material in the worm, in the case of worm gear drives, or in the steel of gears that are going to mate with the bronze gears. In other words, characteristics of this bronze are such that the steels with which it is to mate should be considered carefully to secure maximum life.

Composition *ZZ* is for all practical purposes, composition *XX* hardened with an increased amount of tin. The change of 0.5 per cent lead to 1.0 per cent lead is clearly immaterial in the face of such an increase in the tin content. The change in tin from 10 to 14 per cent makes a very definite increase in the hardness and tends to cause the metal to be somewhat more brittle. The increase in lead does affect machinability to some extent and probably also affects an improvement in this alloy where resistance to leakage is important.

However, this alloy is very rarely subjected to services requiring resistance to pressure of this kind. It is used more particularly for bearings and while there is no phosphorus required in the formula as listed, it is usually produced by deoxidizing the copper with phosphorus in the form of phosphor copper or phosphor tin before adding the white metals thereto. This composition is used for bearings where the loads are relatively heavy and where lubrication is ample.

Publish Index

Committee E-2 on spectrographic analysis, American Society for Testing Materials, has sponsored publication of a 59-page bulletin entitled, "Index to the Literature on Spectrochemical Analysis 1920 to 1937," by W. F. Meggers and B. F. Scribner. The index contains over 900 references on chemical analysis by means of atomic emission spectra. They are arranged in chronological order, and each is numbered. Of particular interest is the detailed index which indicates application, determination, instrument, method, etc. Copies of the bulletin may be obtained from the society, 260 South Broad street, Philadelphia, for $1.

Adventures of Bill

(*Concluded from page* 47)

forgets the entire episode. Daniel Hugh cheerfully admitted that he had drawn freely on a none too trusty memory and had written duplicate letters to about a dozen influential citizens who possibly might interview Judge Bacardey in his behalf.

"He claimed to have worked at the Carabine plant about 20 years ago, but on the spur of the moment could not remember what kind of work he did there. With that obvious prevarication—the plant was closed over 30 years ago—I judged that his other statements were equally wide of the mark.

" 'Wit a whole flock of guys on de job' Mr. Juniper speaking, 'I kinda figured surely one of 'em would spring me out-a-here. There ain't no justice. Me burnin' up here for t'ree mont's a'ready an' not one of 'em doin' a ting about it! Tain't right!'

"When I was about to leave he held out a hand and muttered furtively. 'Ya ain't got a dime on ya to give a fella hey?'

"I sent a report to the west coast man and expressed the hope that some day I might ramble into his princely hacienda, pause for a few minutes to rest my feet, suck up a draft or two from the old oaken bucket and listen to his well considered views that under the present political administration the country is on the greased skids heading for hell in a hand basket.

"Adios! Y'ain't got a dime to help a fella, have ya?"

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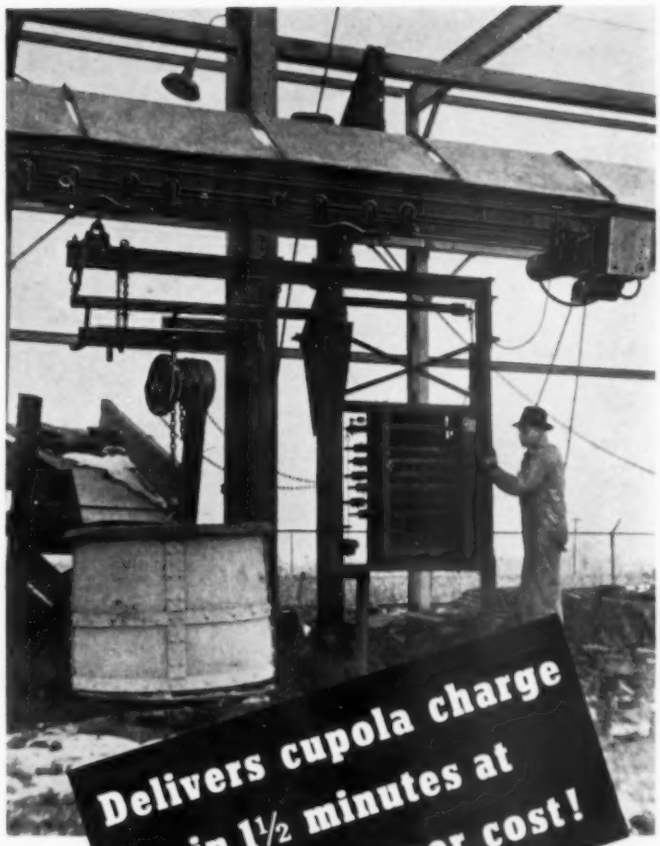

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ENGINEER

Among Detroit Foundries

(*Concluded from page* 35)

for any possible defects. Placed back on the hook conveyor the drums pass through an oil vat or rust inhibitor and on to the shipping platform where they are nested and packed in box cars, one car accommodating some 5000 drums. In regular production, the drums pass from the pouring station to the shipping platform in 1 hour, so that little time is lost in shakeout, cleaning and inspection.

The average brake drum with steel backing weighs about 13 pound and usually is 11 or 12-inch diameter. Some are made without the steel backing plate, but are combined with a forged steel drum.

A large storage yard adjoins the foundry proper, where stocks of pig iron, scrap, coke, refractories, return scrap and other materials can be stored under cover. Cupola charging materials are handled by the conventional type charging car traveling from the scale in the storage yard into the foundry on a short length of straight track. Charges are placed in buckets by an overhead traveling crane in the storage yard, the scale car carrying two of these buckets. After loading and weighing they are moved inside where another crane hoists them and inserts them in the cupola where the bottoms are dropped and the charge placed in the cupola stack.

While these details may represent the simplest of routine foundry practice, numerous pitfalls must be avoided in the production of sound, acceptable brake drum castings. Analysis must be held within close limits, careful control must be exercised over pouring temperatures and time to avoid chills and other defects.

CONTROL of the hardening effects of addition agents to gray cast iron always has been a vexing problem, and one to which considerable research has been devoted. Alloying elements, chromium, vanadium and manganese, have been found to exert a dual effect—one of deoxidation and another of hardening. Both these effects are sought to a certain degree, and the problem often resolves itself into obtaining the proper balance between deoxidizing, or graphitizing, and hardening effects. Hardening effects are intimately associated with cooling rates, the latter being a function of the size and section of the casting. For example, in a cylinder block casting the aim is to have the bores as hard as possible without leaving the outer edges too hard to machine. Hitherto, if hardeners were added to raise the hardness of the bores, then by virtue of the cooling rate the panrails and other edges to be machined were too hard.

In the attempt to reach some sort of automatic balance between the effect of deoxidizers and hardening agents, the Vanadium Corp. of America has been experimenting with alloy additions, seeking some combination of elements which could be supplied to foundrymen as a single addition material. Some degree of success has attended these efforts and the company now is supplying a combination of elements for such a purpose.

About 30 foundries are using the four-metal alloy in production casting work on cylinder blocks, rolls, general jobbing castings and the like. A foundry in this district is using it on cylinder blocks and is reported to be achieving a nice balance between bore hardness and machinability. The alloy is an electric furnace product and is marketed in lots up to carloads.

Technical discussion of the development and application of this new alloy, also metallurgical considerations involved, will be presented in a future issue of THE FOUNDRY.

Ellwood Stone Co., Ellwood City, Pa., has recently acquired the properties of National Stone Co., New Castle, Pa., and is marketing National fire stone for cupola, ladle and converter linings.

How Is Business?

(*Continued from page* 25)

whether (and to what extent) present foundry operations were spotty. About 7 per cent of foundries reporting in the recent survey are operating at less than 20 per cent of capacity, while about 15 per cent indicated operations in excess of 80 per cent of capacity, tending, it might seem, to give some but not full support to spotty operation claims.

Among those foundries enjoying the higher operating rates, there appear those doing a highly diversified line of jobbing work with particular emphasis on machinery castings, aircraft and navy work, ship instruments, electrical items, plumbing and, to some extent, automotive and farm implement work. Foundries at the other extremity are, for the most part, those specializing in one or two fields where activity is still slow, although it should be pointed out that diversification is, in some cases, found in the lower group and specialization in the higher group. To this extent, at least, operation is spotty as might be expected.

In this respect, Table II indicates a relative index of activity with regard to type of foundry work being done. This particular analysis is shown with reservations since it is

(*Concluded on page* 98)

Table III

Breakdown of Opinion on Prospects

Business is GOOD

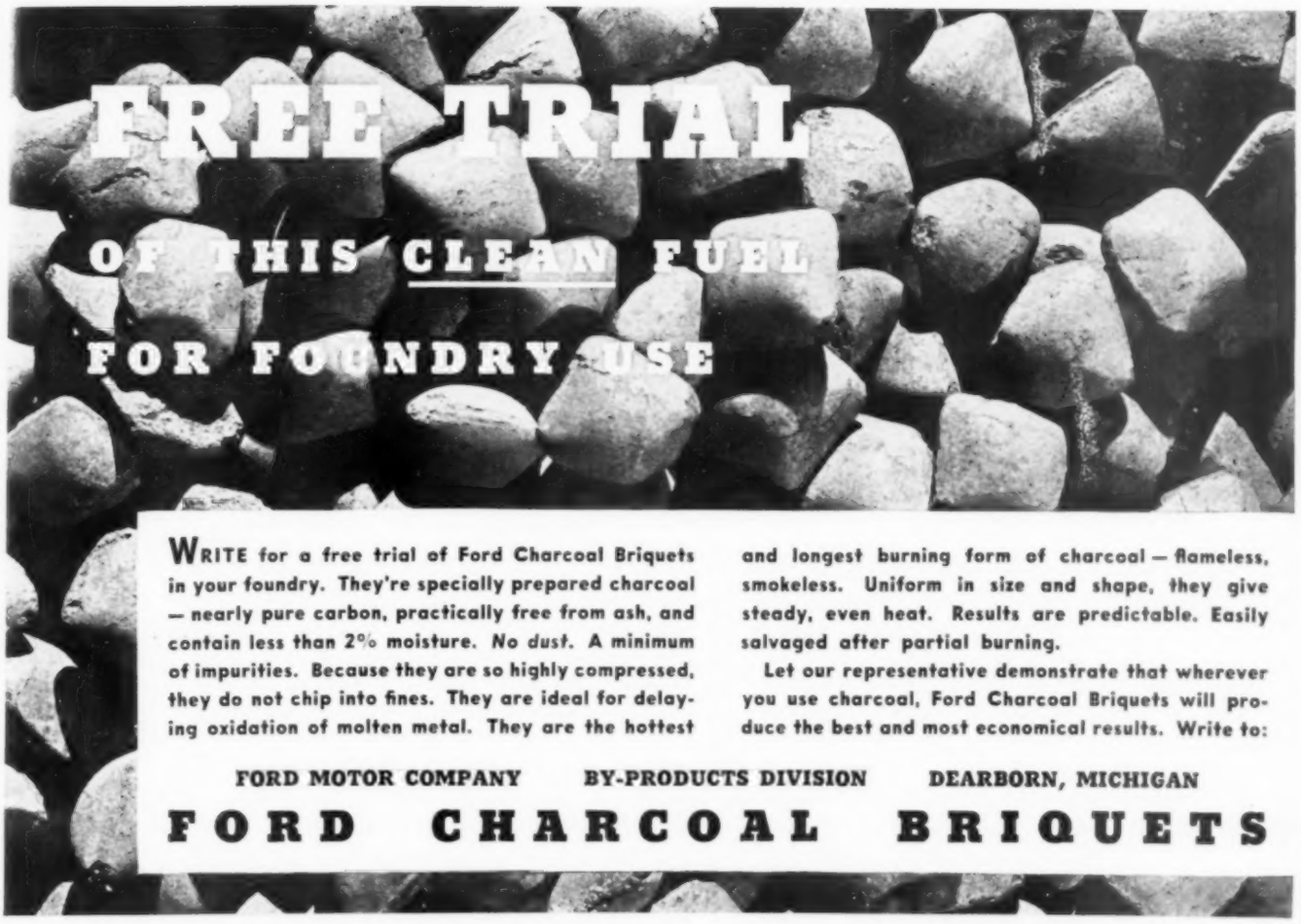
	March Per Cent	April* Per Cent	May and June* Per Cent
Middle West	18	21	20
East	20	30	27
South	22	31	25
Far West	14	19	17
GOOD	**18.6**	**25.0**	**22.5**

Business is FAIR

	March Per Cent	April* Per Cent	May and June* Per Cent
Middle West	58	61	44
East	53	43	36
South	34	38	38
Far West	57	55	48
FAIR	**53.2**	**50.7**	**40.7**

Business is POOR

	March Per Cent	April* Per Cent	May and June* Per Cent
Middle West	24	12	10
East	27	13	7
South	44	28	15
Far West	29	17	9
POOR	**28.2**	**15.0**	**9.6**
***No opinion given**	...	**9.3**	**27.2**



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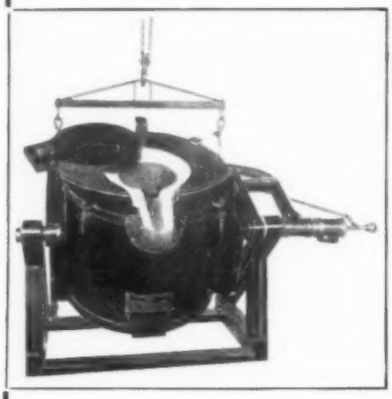


Tilted with Either Electric or Hand Hoist

•

No Impingement of Waste Gases

•

Constant Pouring Arc

•

Built Low for Ease in Charging

The Fisher S.P.C. is recommended for melting yellow brass and for pouring into ingot molds or transfer ladles.

Metal losses are reduced to 5% or less when charging borings—1% on solid scrap and ingot metal.

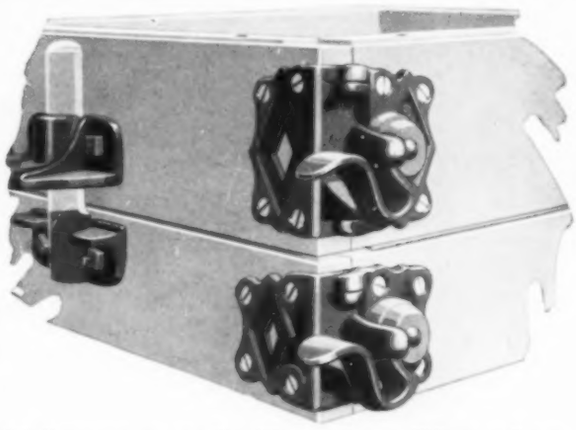
Tilts at the nose—producing a constant pouring arc. Oil or gas fired.

Write for catalogue
"Fisher Products for the Foundry Industry."

"Builders of Melting Furnaces for 32 Years."

FISHER FURNACE CO.

1826 No. Lamon Ave. Chicago, Illinois



Diamond Snap Flasks

STEEL SLIP JACKETS
STEEL BANDS
STEEL CORE PLATES
STEEL BOTTOM PLATES
WOOD CORE BOXES
HARD WOOD WEDGES

Reliable Products Sold Extensively to Foundries for Fifty Years

DIAMOND CLAMP & FLASK CO.

Telephone 2553
RICHMOND, INDIANA

(*Concluded from page* 96)

difficult accurately to determine activity in a given type of casting with the large number of diversified jobbing foundries to take into consideration. However, it was possible to segregate rather accurately those foundries whose principal activity fell into one of the classes shown, thereby providing a basis for making this comparison which is, therefore, merely indicative rather than conclusive.

What are the prospects for business in the immediate future? This question held interesting possibilities and many foundrymen express an opinion. April should be about 10 per cent better than March if anticipations for *good* and *fair* business materialize. This would place the index of foundry activity up to around 60 per cent of capacity. May and June would appear to find the foundry business holding that rate unless it is assumed the 27 per cent not venturing an estimate all expect the worst to happen, which is possible, of course, but not probable. Optimism would appear to be greatest in the East from the breakdown of opinion set forth in Table III.

In a general way and (in order of number of times mentioned) here is what foundrymen are saying and thinking when various phases of business are under discussion:

Favorable Factors

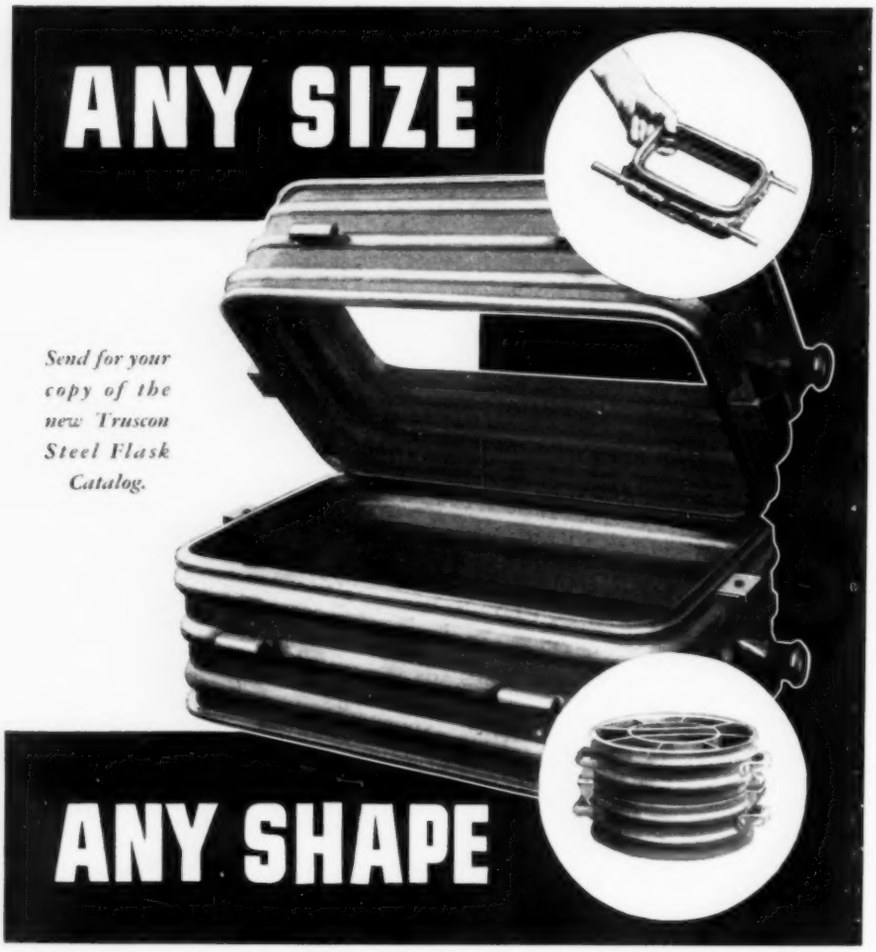
1—Increased government co-operation with business.
2—More settled labor outlook.
3—Revision of tax structure.
4—Wagner act modification.
5—Reduction of government expenditures.
6—Increased railroad buying (and legislation).
7—Adjustment pipe line proration (oil).
8—More consideration of small business.
9—Social security law refinement.
10—Quieting of European situation.

In short, here are brief excerpts from what some foundrymen actually said. On the subject of government co-operation with business: "If the government keeps its word . . ." "Better foundry operation . . . requires a green light from Washington, with the red and amber entirely disconnected." "If Washington would stop talking war, business would go ahead . . ." "The country is ready to go ahead in a big way if we could be let alone . . ." "If business can be relieved of 'artificial stimulants' and given a free rein, we will see better business a lot sooner than expected."

On the subject of recent events, they say: "The proposed closed season for attacks on industry as projected by Secretary Hopkins and the recent Supreme Court's outlawing of labor's racketeering are bound to have good effects . . . the Congress' treatment of the tax question very nearly will decide the whole question . . ." "We believe it should be unnecessary for government to have to coax business to cooperate . . . we are spending to get ready to ride the crest of the wave which surely must come . . . . will come if industry will forget politics for the balance of 1939."

"A more appreciative attitude," comments a Middle Western foundryman, "toward foundry costs, quality and service by purchasing agents would help." Says another, "We hope that some of the foundrymen realize that salaries, depreciation, taxes, and freight are a part of their costs!"

So far as the future is concerned, a foundryman on the West Coast says: "We are optimistic as to the future . . . . there is hope that the railroads will increase their purchases and legislative steps will be taken to assist them." In the East, another states: "We are looking to a good spring and summer business, and a very good fall, from reports we get from the trade . . . orders on our books, etc." Or, as one foundryman puts it: "We must not only talk foundry and write foundry, but must *work* foundry."



Send for your copy of the new Truscon Steel Flask Catalog.

● Truscon can furnish any size and any shape of steel foundry flasks to meet your specifications exactly. And regardless of size or shape, every Truscon Flask combines maximum strength with light weight . . . *a real money-saving combination for you!*

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SAVE TIME AND AIR

MADE OF BAR BRASS and STAINLESS STEEL

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No Buttons or Levers
No Packing Glands
Positive Control with slight Squeeze.

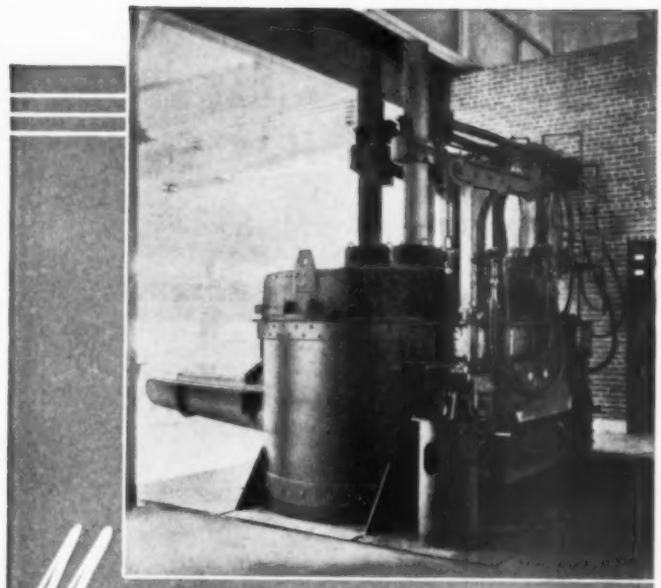
The most efficient air valve or blow gun. Slight pressure between thumb and finger regulates air flow from slight discharge to full blast. All operating parts enclosed. Maintenance negligible. **THOUSANDS IN USE BY LEADING PLANTS.** Order sample on 30 days approval.

AIR-WAY PUMP & EQUIPMENT CO.
625 F WEST JACKSON BLVD. CHICAGO, ILLINOIS

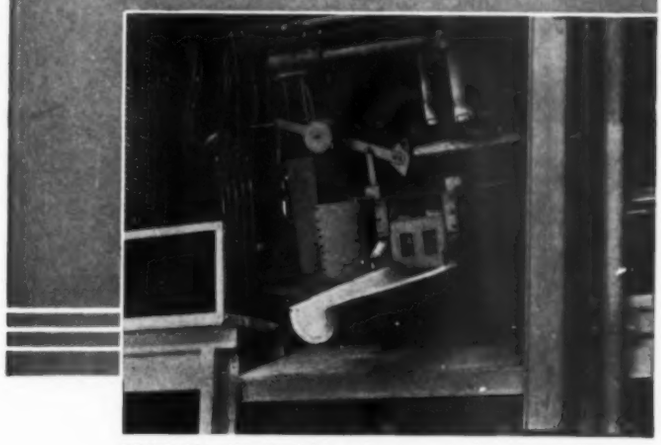
Foundry RIDDLES
HERE is a foundry riddle that will stand the "gaff" because it has been constructed and designed especially for foundry use. "Buffalo" riddles are noted for long life and the ability to do faster, cleaner work. It will pay you to try Buffalo's the next time you buy riddles.
Available in three stock sizes: 16", 18" and 20" diameter with mesh of either steel, galvanized, tinned or brass wire cloth, supported by two, three or four wires as specified. Ask Us For New Folder No. 91-B

"We are not connected with any other wire weaving company in New York State or any other part of the United States."

Buffalo WIRE WORKS Co., Inc.
425 TERRACE, BUFFALO, NEW YORK
Branch Office & Warehouse: 11 South 7th St. Philadelphia, Pa.



Modern Heroult
IMPROVEMENTS IN ELECTRIC FURNACES



TYPE 1½ *Heroult Electric Furnace showing floor tilting, copper tubing, and wedge type electrode holders.*

FOUR major innovations make Heroult Electric Furnaces more efficient than ever —

Floor attached to shell tilts with furnace.

Water-cooled copper tubing, with suitable separation from mast arms, carries current to electrodes to prevent hysteresis and eddy current losses.

Improved wedge type electrode holders.

Lightweight welded roof coolers.

Heroult Electric Furnaces have gained a remarkable reputation for efficient melting and refining of all kinds of ferrous materials by basic or acid process—including alloy, tool and forging steels, iron and steel castings. Any capacity from ½ ton to 100 tons; removable roof, chute, machine or hand charging.

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General Offices: Frick Building, Pittsburgh, Pa.
Baltimore Boston Chicago Cincinnati Cleveland Denver
Detroit Duluth Minneapolis New York Philadelphia St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

OBITUARY

William W. Nichols, 31, secretary, Cox Foundry & Machine Co., Atlanta, Ga., died Feb. 14.

Judson J. Whitehead, founder and president, Whitehead Metal Products Co., Inc. died Feb. 28.

Fred E. Key, 70, vice president and general manager, Key Co., East St. Louis, Ill., died at his home in St. Louis recently.

Thomas J. Fegley, 82, vice president and director, North Bros. Mfg. Co., Philadelphia, died March 1 in that city.

William C. Ehrhardt, 67, secretary, John C. Kupferle Foundry Co., St. Louis, died recently in that city. Mr. Ehrhardt had been connected with the company for 52 years.

W. Carlton Speck, 52, superintendent, Buckeye Steel Casting Co., Columbus, O., died recently at his home in that city. Mr. Speck was a native of Columbus and a graduate of Purdue university. He began his career as an apprentice in the Pennsylvania Railroad shops and following his graduation from Purdue went with the Buckeye company as an apprentice. He has been superintendent of production since 1929

William L. Donlan, 50, part owner of the Gardner Foundry Co., Gardner, Mass. died recently in Fitchburg, Mass. Before Mr. Donlan and his brother formed their own foundry company he was a superintendent of the Goodnow Foundry Co., Fitchburg.

John L. Green, 65, president for the past 30 years of Laclede-Christy Clay Products Co., St. Louis, died recently at his home in that city. Mr. Green was born in St. Louis and was the son of James Green, founder of the Laclede Fire Brick Co.

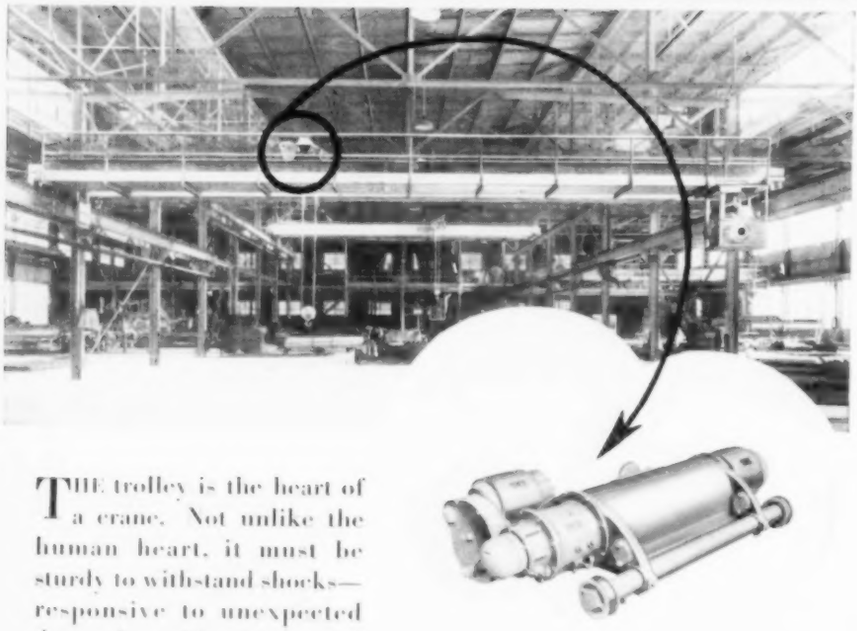
Joseph Wittasek, 61, foreman, Hill Clutch Machine & Foundry Co., Cleveland, recently died in his home in that city. Mr. Wittasek was born in Cleveland, and had been employed by that company as foreman for 10 years. Before that time he was connected with the old Interstate Foundries Corp.

Homer M. Wright, 47, for 23 years connected with the Michigan Malleable Iron Co. Detroit, as metallurgist, died Feb. 20 in that city. Mr. Wright had done much in developing new uses for malleable iron. He pioneered in the development of pearlitic iron and at the time of his death was head of the Technical committee, Malleable Founders' society.

A. M. Clark, 67, president, Columbia Steel Casting Co., Portland, Oreg., and the first maker of commercial steel castings in the northwest, died in San Francisco, Feb. 10 while on a vacation. Mr. Clark was born in Aurora, Ill., Nov. 7, 1871. At an early age he entered the employ of the C. B. & Q. railway and later the Sargeant Co. as an apprentice specializing in the steel making division. Mr. Clark was active in the development and growth of the Columbia Steel Co. formed in 1910. In 1931 Mr. Clark purchased the foundry at Portland and devoted his efforts to that enterprise until the time of his death.

ADOLPH W. LEMME, 65, president, Elizabeth Street Foundry Co., Chicago, died March 9 following an illness of several months. Mr. Lemme had been connected with the foundry industry for many years. He began his career in the shops of the Chicago & Alton railroad, Bloomington, Ill., as a molder. Later he became connected with the Hewitt Foundry Co., Chicago. He then joined the Chicago Bearing Metal Co., Chicago where he rose to the position of superintendent and he held that position for 20 years. In 1925 he established the Elizabeth Street Foundry Co., but has been inactive in the affairs of the company for the past 2 years.

OVERHEAD
Electric Traveling Cranes
CAPACITIES 1 TO 450 TONS



THE trolley is the heart of a crane. Not unlike the human heart, it must be sturdy to withstand shocks—responsive to unexpected demands—with stamina and endurance for hard work day after day.

A detailed description of the heart of a Shepard Niles crane is given in Bulletin No. 123. A copy is yours for the asking.

A few of the features that contribute to the long life and trustworthy service of Shepard Niles crane trolleys are—load carrying frame of steel—balanced drive gearing—automatic oil bath lubrication and complete enclosures for all vital parts.

A COMPLETE LINE OF CRANES & HOISTS

SHEPARD NILES CRANE & HOIST CORP.

360 SCHUYLER AVENUE . . . MONTOUR FALLS, N. Y.

Be Sure Your AIR Is Right!

As every foundryman knows, scrap losses run high and coke is wasted when air blast to cupola is not easily and accurately controlled.

Roots-Connersville Rotary Positive Blowers with their simple control — either manual or automatic — delivering exactly the right amount of air to any cupola, supply the key to worthwhile savings.

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CONNERSVILLE
BLOWER CORPORATION
904 Madison Ave.
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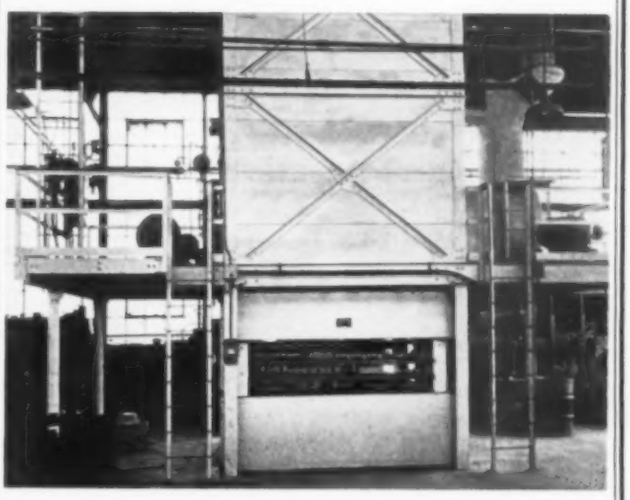
THE BEST KNOWN NAME IN IRON
★
HANNA PIG IRON

BRANDS: Buffalo, Detroit, Susquehanna
GRADES: Foundry, Malleable, Silvery, Ferro-Silicon

THE HANNA FURNACE CORPORATION
MERCHANT PIG IRON DIVISION
OF NATIONAL STEEL CORPORATION
Buffalo Detroit New York Philadelphia Boston

VERTICAL CORE OVENS
By
Carl-Mayer



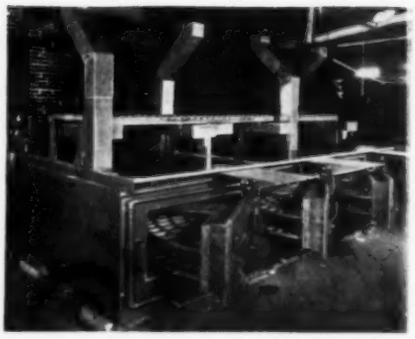
Oil Fired Vertical Oven—Patent Pending, built for a General Motors Subsidiary

Also all
OTHER TYPE CORE AND MOLD OVENS
Write for literature to:
THE CARL-MAYER CORP.
3030 EUCLID AVE. CLEVELAND, OHIO

Unit Core Oven

Ferdinand G. Schultz, 215 Questend avenue, Pittsburgh, has designed a unit system core oven for automotive and other production shops which offers continuous flow line production. The oven is built in 2-man, 4-man, or 6-man units or multiples of those. A 6-man unit is approximately 37¼ inches high, 7 feet wide, and 12 feet long. It contains three separate ovens, each served by two men who maintain oven temperature to suit their particular type of cores. As shown in the accompanying illustration, a roller conveyor 12 feet long runs over the middle of the unit. Top of the unit serves as the work bench for the core maker. A set-off shelf 18 x 20 inches which slides out of the way when not in use, is provided for each coremaker.

Arrangement of the unit system core ovens is such that each pair of coremakers without leaving their stations, mix sand, make cores, bake them, etc., eliminating considerable handling. Floor space is reduced to a minimum and conserves heat, light, and general overhead expense. Since each coremaker has complete control of his cores, losses and defects can be traced, analyzed, and remedied.

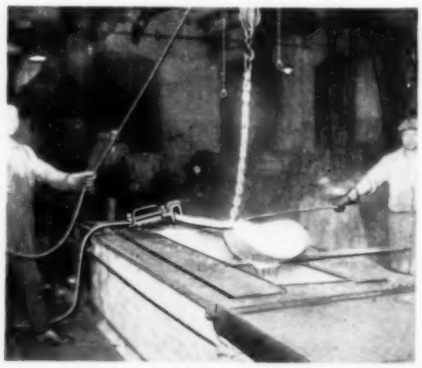


Top of oven consists of a steel plate, insulated from the oven. Ovens are insulated and gas is used for fuel. An adjustable thermostat can be set for predetermined maximum temperature. Core racks or shelves are adjustable, and suspended from the heavy door. When door is opened to place or extract cores, an auxiliary door closes inside the oven to prevent excessive heat loss. Each oven is operated independently of the others.

THE ADVANTAGES
OF UNIFORM
PIG IRON
Many serious foundry troubles may be avoided by the use of pig iron of matchless uniformity, as produced by Sloss.
All three brands of Sloss pig iron are made from ores produced by Sloss' own mines, using red ore as a base plus a scientific blending of special brown ores. Thus, Sloss is enabled to burden its blast furnaces with ores of such uniformity that high grade pig iron of uniform analysis is assured.
In addition, all brands of Sloss iron have the exclusive advantage, as the molten iron discharges from the blast furnace, of being thoroughly mixed in a specially designed mixing ladle (see photo above) that holds 125 tons—more than an entire single cast from a blast furnace! This mixing doubly insures that every pig of each cast is absolutely uniform in chemical analysis and physical properties.
The uniformity of Sloss Pig Iron will keep your foundry casting losses down to a minimum—as it does for others. Address inquiries to Sloss-Sheffield Steel & Iron Company, Birmingham, Ala.
SHIRT SLEEVE SERVICE
SLOSS
SPECIALISTS IN FOUNDRY IRON
LADLE-MIXED FOR UNIFORMITY

Scoop Vibrator

New Haven Vibrator Co., Inc., 131 Chestnut street, New Haven, Conn., has developed a special type vibrator for use with the scoops employed in hot dip galvanizing and the skimmers used over the baths where hot dip tinning is practiced. Size of the vibrator varies according to the size of the scoop or spoon which range in width from 18 inches and in length up to 60 inches. The device may be operated by hand on small installations. On larger installations the device is suspended from a monorail. Two blocks are provided, one for the vibrator and the other for a slicing device over the scoop. It is claimed that this method of handling dross and skimmings has effected savings up to 40 per cent in the amount of zinc or tin purchased for a given amount of work. The slicing device eliminates the hot job formerly connected with a hot bath. The device is operated with compressed air at pressures from 60 to 80 pounds per square inch.



Gray Cast Iron

BY JOHN W. BOLTON

An outstanding, new book which presents in detail all of the latest developments in raw materials, practices, metallurgy and engineering properties of gray iron castings. The author, John W. Bolton of the Lunkenheimer Company, Cincinnati, Ohio, is a recognized authority on these subjects.

Twenty-two chapters discuss such phases of gray iron foundry practice as melting processes, casting defects, design, effects of regular and alloying elements, superheating, heat treatment, physical properties, machinability and wear, effect of temperature on mechanical properties, corrosion, and specifications.

Clearly and simply written, *Gray Cast Iron* is easily understood, even by beginners.

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Bound in dark red cloth, heavy board cover, cross indexed for easy reference. Contains 400 pages, 262 illustrations on high grade book paper. Attractively printed and arranged.

Price $5 Postpaid

A BOOK FOR THE LIBRARY OF EVERY GRAY IRON FOUNDRYMAN

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Enclosed is $5* for which please send postpaid, one copy of GRAY CAST IRON by John W. Bolton.

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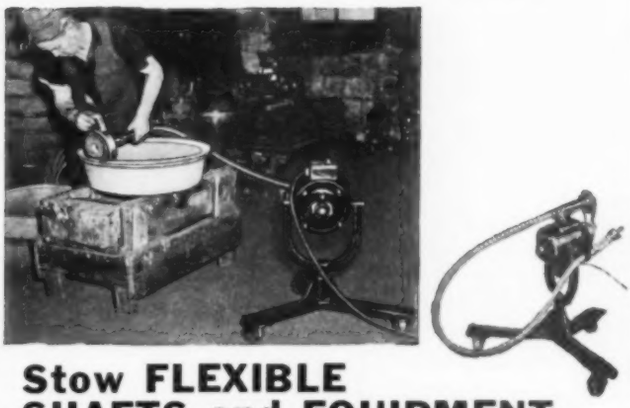
Here's the Modern—More Economical Way To

CLEAN—GRIND!



Stow FLEXIBLE SHAFTS and EQUIPMENT

Stow Flexible Shafts and Flexible Shaft Equipment are brought to castings anywhere in the foundry, speedily, for economical cleaning and grinding. You get a better finish, a more acceptable casting to meet modern competition. 10 different mountings, high or low speed, ⅛ to 10 HP.

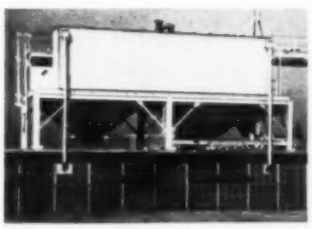
WRITE FOR CATALOGUE 38

INVENTORS OF STOW FLEXIBLE SHAFTS 1875

STOW MFG. CO., Inc.

23 SHEAR ST. BINGHAMTON, N. Y.

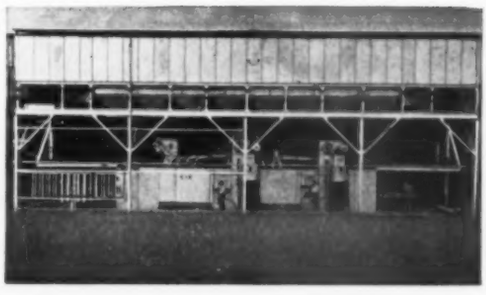
PARSONS DUST CONTROL



SUPER-SERVICE at low cost is "clear" when you use a Parsons Dust Collecting System.

Engineers and foundrymen are quick to notice the "calibre" of equipment.

Whether conditions call for wet or dry systems, they say Parsons is "tops".



PARSONS ENGINEERING CORPORATION
CLEVELAND, OHIO

FOUNDRY ACTIVITIES

LIMA LOCOMOTIVE WORKS, Lima, O., has received an order of 12 new engines for the Southern Pacific Railroad Co. and will start work on the order about May 1.

* * *

Plaster Process Castings Co., 6924 Carnegie avenue, Cleveland, recently was organized to produce nonferrous castings. The company will specialize in aluminum matchplates pressure cast in plaster molds. George P. Madison is president, Robert A. Reich, vice president and L. Beinke, secretary-treasurer.

* * *

International Harvester Co., will spend approximately $3,000,000 in the next 18 months to modernize and rearrange its Milwaukee plant. Program includes complete rehabilitation of the foundry to equip it for specialization in production of large castings. Also the company is spending $1,000,000 to complete the foundry at the motor truck plant, Indianapolis.

* * *

Harry F. Uetzel recently has taken over the Bronze Foundry Co., Ashland, Pa., and is now operating the business under the name of Uetzel's Foundry.

* * *

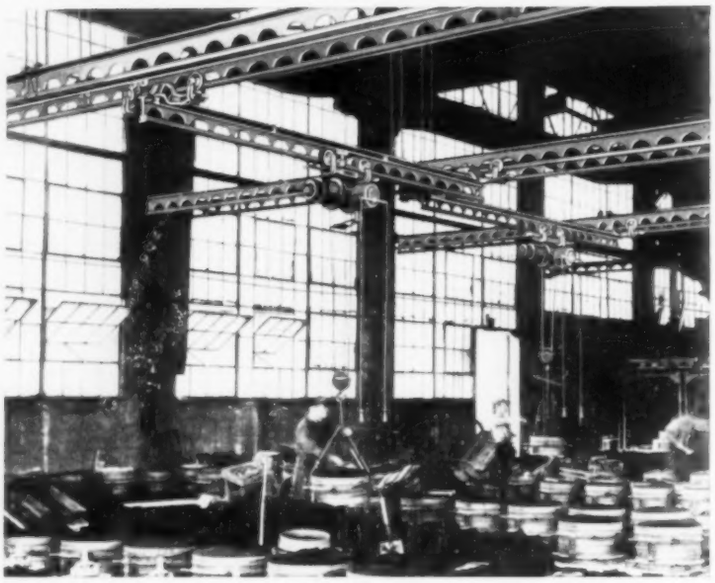
Index of foundry equipment orders for February, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 135.3 as compared with 122.3 in January and 90.4 in February, 1938. Index of shipments was 112.2 as compared with 96.3 in January and 80.9 in February, 1938.

* * *

Appointment of Dr. Gaylard M. Leslie, president of the company and James H. Haberly, president, First Federal Savings & Loan association, as trustees of the Bass Foundry & Machine Co., Fort Wayne, Ind., was made permanent recently by order of Federal Judge Thomas W. Slick. The company is reorganizing under the federal bankruptcy act.

CLEVELAND TRAMRAIL

OVER HEAD HANDLING EQUIPMENT



• Tramrail cranes and transfer bridges, which are part of the extensive overhead handling system in this foundry, give complete and flexible coverage for handling of the larger molds. Complete, because the entire floor is served; Flexible because, just the right number of units are operated when production is low, — no unused equipment in motion.

ALSO BUILDERS OF CLEVELAND CRANES ALL WELDED

CLEVELAND TRAMRAIL

DIVISION OF

THE CLEVELAND CRANE & ENGINEERING CO.

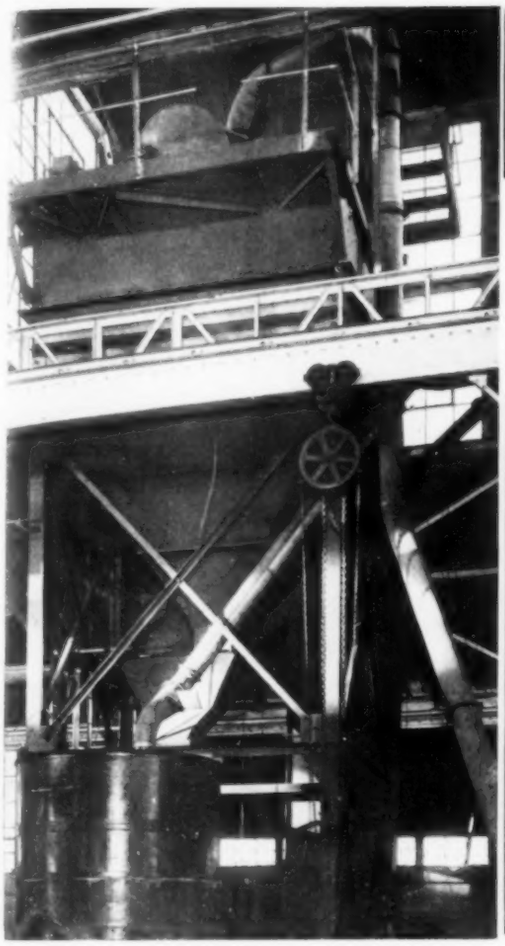
1155 Depot St.

WICKLIFFE, OHIO.

Or Consult Your Phone Directory under Cleveland Tramrail

RAW MATERIAL PRICES
March 23, 1939

Iron		
No. 2 foundry, Valley		$21.00
No. 2 Southern Birmingham		17.00
No. 2 foundry, Chicago		21.00
No. 2 foundry, Buffalo		21.00
Basic, Buffalo		20.00
Basic, Valley		20.50
Malleable, Chicago		21.00
Malleable, Buffalo		21.50
Charcoal iron, furnace		25.00
Coke		
Connellsville beehive premium	$5.50 to	$6.30
Wise county beehive coke	5.50 to	6.50
Detroit by-product delivered		10.25
Scrap		
Heavy melting steel, Valley, No. 2	$14.00 to	$14.25
Heavy melting steel, Pittsburgh, No. 2	14.75 to	15.25
Heavy melting steel, Chicago, Auto No. 2	11.50 to	12.00
Stove plate, Buffalo	13.00 to	13.50
Stove plate, Chicago	8.00 to	8.50
No. 1 cast, mchy. New York	12.00 to	12.50
No. 1 cast, mchy., Chicago	12.00 to	12.50
No. 1 cast, Pittsburgh	15.25 to	15.75
No. 1 cast, Philadelphia	16.50 to	17.00
No. 1 cast, Birmingham	14.00 to	14.50
Car wheels, iron, Pittsburgh	15.00 to	15.50
Car wheels, iron, Chicago	13.50 to	14.00
Railroad malleable, Chicago	15.50 to	16.00
Malleable, Buffalo	13.50 to	14.00
Nonferrous Metals		
		Cents per pound
Castings copper, refinery		10.35
Straits tin		46.25
Aluminum, 99 per cent		20.00
Aluminum, No. 12 (Secondary, standard)	12.50 to	13.00
Lead, New York		4.85
Antimony, New York		11.25
Nickel, electro		35.00
Zinc, East St. Louis, Ill.		4.50

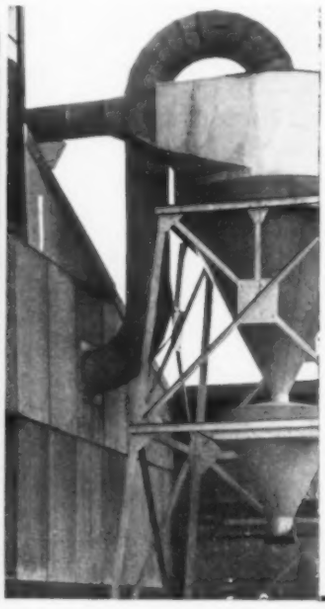


KIRK & BLUM
Dust Collecting Systems

At the Electric Steel Casting Company, Indianapolis, a K & B Dust Collecting System serves the sand conditioning equipment, a large storage hopper and bucket elevator. The air required to ventilate this equipment is drawn through a K & B Cyclone Collector which separates the dust and sand from the air stream and deposits it in a small storage bin for truck loading.

There is also a cloth-screen type dust arrestor that removes practically all dust from air used in casting cleaning operations. By recirculating this clean air in the plant, considerable heat is saved and outside dust eliminated.

Why not let our engineers show how you, too, can remove dust from your plant effectively and economically? Write for details of this service and copy of interesting Book—"Dust Collecting Systems in Metal Industries."



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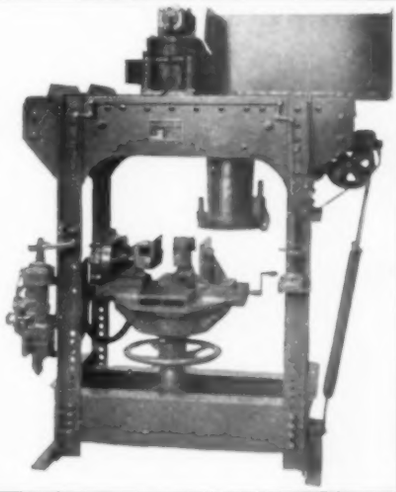

NEW TRADE PUBLICATIONS

ANALYSIS—"Modern Analysis" is the title of a recent booklet issued by the Harry W. Dietert Co., Detroit. Equipment illustrated and described includes spectrographs, densitometers, micropipettes, film dryers, carbon and sulphur determinators.

CLEANING SYSTEMS — Connecticut Blower Co., Hartford, Conn., has published a 4-page leaflet describing its industrial vacuum cleaning systems and dust control equipment.

GAS MASKS—Mine Safety Appliances Co., Pittsburgh, has issued a 4-page bulletin which describes and illustrates its line of industrial gas masks.

MATERIALS HANDLING — Cleveland Crane & Engineering Co., Wickliffe, O., has issued a 4-page bulletin describing applications of its equipment specifically designed to increase the size of unit loads through production.

TRUCKS — Type IZ load carrier truck has been described and illustrated in a recent bulletin published by the Elwell-Parker Electric Co., Cleveland. Construction details of the truck are illustrated as well as various models shown in operation.

MAGNETIC CLUTCHES—Stearns Magnetic Mfg. Co., Milwaukee, has issued bulletin 225 of 16 pages describing its line of magnetic clutches. Included are specifications and schematic drawings of various models as well as photographs reproduced to show typical applications of these models.

CLEANING—A folder issued by G. A. Blakeslee & Co., Cicero station, Chicago, describes its equipment for washing metal articles prior to finishing work. Featured are the methods of washing, rinsing and drying the articles by the machinery, with various models illustrated.

WELDING ELECTRODES — Harnischfeger Corp., Milwaukee, recently has issued a catalog which illustrates and describes its line of welding electrodes and welding equipment. This 28-page booklet includes many details of analyses and applications. Five pages of spark tests for various steels are included.

HEAT TRANSFER — Ferro Enamel Corp., Cleveland, recently has published a booklet by J. C. Bell, "Heat Transfer for Porcelain Enamel Metals and Other Materials." This technical bulletin is the report of an original investigation by one of the staff members of the company's research laboratories. It is the first of a series of such bulletins.

HEATING EQUIPMENT — Industrial Gas Engineering Co., 201 East Ohio street, Chicago, has issued a 52-page book containing specification sheets, drawings and reproduced photographs of gas heating units and high temperature exhausters. The various models are described and construction details emphasized.

EYE PROTECTION—"How to Fit Eye-Protection Goggles to Workers for Greatest Comfort and Safety" is the title of a pamphlet recently issued by the American Optical Co., Southbridge, Mass. The pamphlet is divided into two parts: One section is devoted to instructions on the fitting of eye-cup goggles, the other to the spectacle type of goggles. These sections may be posted on bulletin boards.

CLEANING — United States Hoffman Machinery Corp., air appliance division, 105 Fourth avenue, New York, has issued booklet No. A-303 dealing briefly with dust hazards. This 8-page booklet describes special applications designed to simplify industrial cleaning problems and illustrates the cleaning units ranging from 1½ to 5 horsepower. Much practical working information is included for adapting vacuum cleaning to varied industrial uses.

Copies of any of the literature listed here may be obtained by writing directly to the companies involved, or by addressing THE FOUNDRY, in care of Readers' Service Department, 1213 West Third Street, Cleveland

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